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ABSTRACT

This book is designed as a resource for teachers and parents concerned with early childhood education. It is hoped that the ideas and activities presented herein will serve in the creation of a space science and mathematics curriculum that is both child-centered and exciting. The basic philosophy for this curriculum is that of Piaget. This approach establishes the basic understanding of math and science curriculum through sensory experiences. Activities contain the Name of the activity (e.g., clouds, constellations, kites, aerospace pioneers, rockets, space sensations, and space mail), Subject/Sense (math or science and which senses are emphasized), Skill, Procedure, Parent/Child Experience, Objective, and Background Information. Additional material includes a list of teacher resource centers, an annotated bibliography on children's books relating to aviation and space (contains 93 references), suggestions for using a constructible shuttle cabin with children, information about toys in space, and photographs. (PR)

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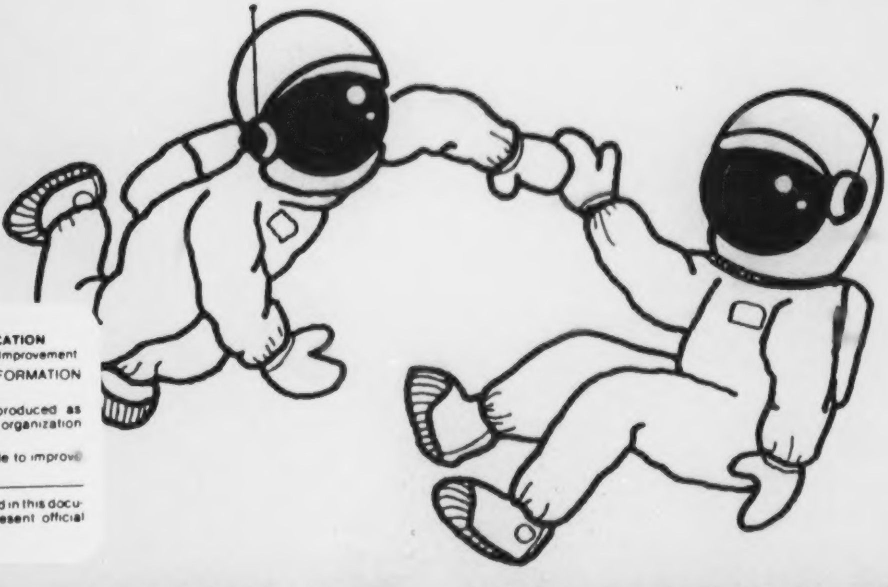
ALL ABOARD FOR SPACE



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ALL ABOARD FOR SPACE

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All Aboard for Space

1992

Journey Through Air and Space, Copyright © 1986, Revised edition 1987
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Preface

ALL ABOARD FOR SPACE represents a logical and well thought out approach for introducing space to youngsters. The importance of starting with a basic level, the earth and its characteristics, the atmosphere and what it provides and how man adapts to this normal environment is recognized. Then the youngsters can move logically from the friendly atmosphere into a space that we can only imagine and our total knowledge is bounded by what we hear, see or feel. We are totally dependent on books, movies, and word of mouth. This approach makes it real. I had the feeling of actually being there when I finished reading it. And even though I've been there, I actually learned a lot!

Frederick Gregory

Colonel Frederick Gregory
NASA Astronaut
Pilot, STS 51-B
Commander, STS-33
Commander, STS-44

Introduction

This book is designed as a resource for teachers and parents concerned with early childhood education. It is hoped that the ideas and activities presented herein will serve in the creation of a space science and mathematics curriculum that is both child-centered and exciting. The basic philosophy for such a curriculum is based on that of Piaget:

> "The principle goal of education is to create men who are capable of doing new things, not simply of repeating what other generations have done--men and women who are creative, inventive and discovers. The second goal of education is to form minds which can be critical, can verify, and will not accept everything that they are offered. The great danger today is of slogans, collective opinions, ready made trends of thought. We have to be able to resist individually, to criticize, to distinguish between what is proven and what is not. So we need pupils who are active, who learn early to find out by themselves, partly through their own spontaneous activity and partly through materials we set up for them; who learn early to tell what is verifiable and what is simply the first idea to come to them"

(Piaget, 1954)

As we begin our journey through space we need to understand what we are going to look for, just like a pilot goes to ground school before he starts to fly an airplane. We need to have some information about our earth (physics) and environment (ecology) before we enter into this new environment of space (astronomy). (See SCIENCE section)

There is no weather in space. Why? What are clouds? How are they formed? This is what begins our space adventure. Concepts such as these will be discussed prior to entering space. What is in space? Planets and stars! How do we get into space? In rockets and Space Shuttles. The effects of the atmosphere on different flying objects is crucial if we are to learn about how to travel in space. Different objects fly differently depending on how the air affects the object. We will see how air affects kites, balloons, helicopters and airplanes. Then we can see how the Space Shuttle was designed to accommodate all these concepts.

A basic understanding of space must include things in space: clouds, stars and planets and things that fly: balloons, kites, airplanes, rockets and the Space Shuttle. Preparing to be an astronaut includes learning about what to wear, what to eat and how to keep fit. All activities will focus on the aspect of space adventure and emphasize sensory experiences to re-emphasize Piaget's belief that "Children must learn through the materials we set up for them": Sight (recognize properties, compare shapes, colors, puzzles, collages), hearing (sound, music, describing sounds); taste (sweet, bitter, salty and sour through cooking); and touch (contact with objects--warm, cold, pain, pressure, tracing, textures).

The aerospace curriculum will be initiated in the classroom by reading the first part of this book, which establishes the basic understanding of math and science curriculum through sensory experiences.

The curriculum activities are based on the following format:

Name

Subject/Sense (Math or Science and which Senses are emphasized)

Skill

Procedure (The activity will be described, with a list of required materials or resources.) If more than one activity is presented, choose one or more depending on your interests and the level of your children. Vary and adapt the activities as you wish!

Parent/Child Experience (An activity the parent or relative or friend can do at home with the child is described.)

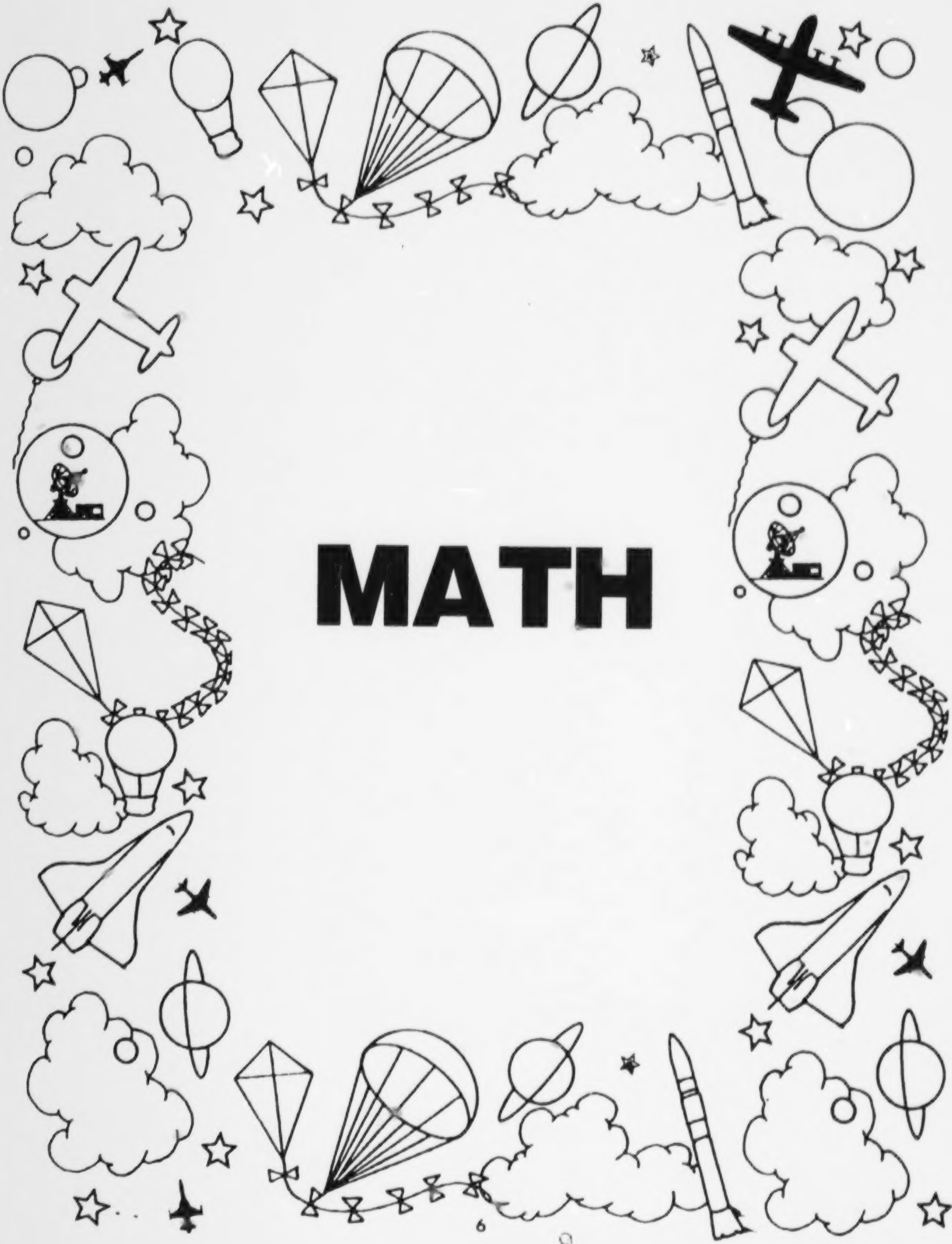
Objective (What the child will do at home is listed.)

Background Information (Information is provided for the teacher)

File folder activities will help you become organized and prepare for the early childhood aerospace curriculum. These practical folders not only are inexpensive to develop but are easy to store and use in a learning center.

Making file folder games out of simple file folders, patterns in the book and colored marking pens are all you need to make your own activities. You can make variations as suggested or use your own imagination to individualize folders based on the students' developmental level. These unique folders encourage the teacher/parent to take an active role in designing curriculum for the child. It is not a ready-made kit or book that merely requires presentation. Many other activities are provided to extend the folder concepts to the home and outdoor environment. These related activities will involve additional teacher/parent preparations and additional materials, i.e., bringing in a hotplate and teakettle to watch "clouds" form.

Piaget, Jean, The Construction of Reality in the Child, New York: Basic Books, Inc.,



MATH

MATHEMATICS IN EARLY CHILDHOOD

Early childhood educators know that young children learn by manipulating objects. However, it is difficult to tell someone what the child has learned.

Piaget identified two types of knowledge children learn when they manipulate objects. In science, it is known as physical knowledge (knowledge of objects that can be observed). In math, it is known as logicomathematical knowledge. Logicomathematical knowledge is created when we make relationships between objects, i.e. when we compare 2 balloons (1 red, 1 blue). Relationships between 2 objects are observable, but the relationship (same-different, number (two), color) are created in the person's mind. When the child builds with blocks, he looks for blocks to make his rocket taller. Thus, the logicomathematical knowledge is dependent on his physical knowledge.

Children learn through their senses. Piaget extended this belief by showing children can only obtain sensory information if they act on the object mentally and physically. The child must handle the object manipulation is essential. The child will gain physical knowledge after interpreting the sensory experience using his logicomathematical framework

We want children to have the opportunity to think. We need to create situations that are meaningful at this particular age, allow them to make decisions and give them the opportunity to talk with their peers to solve problems and exchange ideas.

We have tried to create choices in this book for the child and the adult. Basic skills and concepts in math and science will be discussed, but remember to create the activities with your students or children so sensory learning takes place.

Mathematical experiences in the early years should be based on a teacher knowledge of what to teach and understanding of the children to be taught. Piaget's work has helped produce programs that emphasize the development of broad intellectual powers, rather than the mastery of limited specific skills. He has identified certain stages of development. The preoperational stage of development will be the focus of the age group of this book. The preoperational stage begins about age one or two and lasts until approximately age seven. Learning must occur through play at this age. The child has difficulty with conservation. He needs many experiences to test and find out for himself. He needs to manipulate, explore and make choices. The real concrete experiences help him develop the thinking processes.

In the preoperational phase the child will classify things by a single feature (such as size). There is no concern about apparent contradictions (relationship between size and weight such as when a large light object floats and a small heavy object sinks.) The characteristic phrase is irreversability. The approximate age range is 2 to 4 years. In this phase classification begins to emerge. There is gradual awareness of mass, weight and volume. (Amount remains the same even if transferred to a container of different size and shape.) The approximate age range is 4 to 7 years. What should be involved in a math program for young children? The teacher needs to give attention to the development of number understanding. This is based on two levels of knowledge on the part of the learner:

Quantitative attributes and relationships of objects in the world (i.e., He has more airplanes than me. My rocket is higher than yours.)

Symbols used to represent these attributes and relationships (i.e., He has 4 airplanes and I have 2 airplanes.) To develop number understanding the classroom should provide the children with many concrete experiences to understand quantity and relationships before they are introduced to number symbols. Then number symbols should be introduced. Number understanding experiences in this book could be divided into the following goals:

Number and numerations: The ability to identify the properties of a collection which answers the questions how many or which one.

Measurement: The ability to express the size of a particular object.

Geometry: The ability to understand position in space. These goals could be broken down into the following concepts.

Number and numerations:
Sorts objects by similarities
Recognize a pattern
Arranges (orders) objects according to size, shape, color (seriation)
Matches objects of sets one-to-one
Recognizes/names number of items in a set up to five
Counts number of items in a set up to 10
Combines and separates sets of objects by a given characteristic (classify)
Selects numeral that names the number of elements of a set up to 10

Measurement
Compares two objects according to size
Measures length by counting nonstandard units

Geometry

Moves oneself, or an object from one point to another point using given directions

Sorts and identifies basic geometric shapes (circle, square, triangle, rectangle)

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Beihler, Robert F. *Psychology Applied to Teaching*, Boston: Houghton, Mifflin, Co., Inc., 1971

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Kamii, Constance, *"How do Children Learn by Handling Objects?"* Williams, Connie K. Young Children, Nov. 1986

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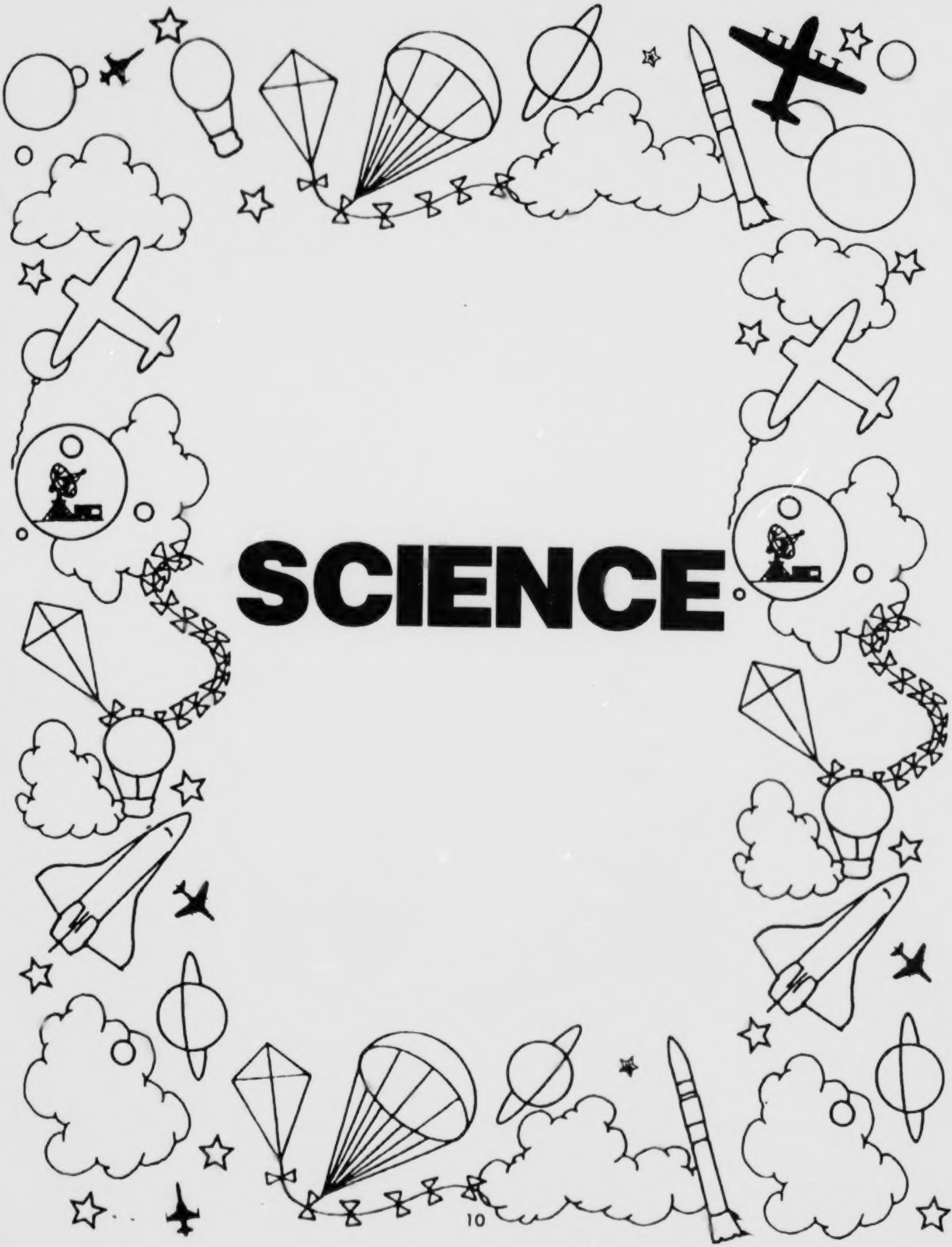
SCIENCE



SCIENCE IN EARLY CHILDHOOD

Children are natural scientists with their spontaneous curiosity. They explore, discover and experiment with their environment. They need opportunities to develop skills in observing, questioning and solving problems. Children in the early childhood stage have already begun to explore their environment through their senses, but they don't have the thinking skills developed to understand their surroundings. Children will need to explore and manipulate objects in their environment to arouse their curiosity and interests. Then the adult can extend this curiosity to develop the child's language, knowledge and thinking abilities. Activities in this book will provide opportunities in:

Observing (find differences in objects, i.e. color, size, shape, texture)

Classifying (find likenesses and differences, i.e. These fly. These do not fly)

Predicting (make predictions, i.e. These dark clouds mean it's going to rain)

Reporting (describe observations verbally, i.e. Powdered orange drink tastes different from fresh orange juice)

These goals can be broken down into the following concepts:

Sorts by shape, color, size, texture
Identifies colors
Identifies objects by characteristics such as lighter-heavier, larger-smaller, floatable-non floatable
Describes differences in weather from day to day
Identifies hot-cold, wet-dry, light-dark
Identifies sounds such as loud-soft, high-low
Identifies time frames such as day, night, yesterday, today, tomorrow
Identifies motion such as push, pull
Identifies and experiences activities using the five senses

Teachers will need to plan activities in the classroom that respond to the child's curiosity and interests as he is motivated through space science and man's relationship to this new environment. Space science involves experiences in physics (matter and energy), astronomy (our earth and the universe) and ecology (humans and our environment). Examples of concepts and activities in these areas follow.

Matter and energy (physics) Air is around us Air fills space Wind moves many things Heat changes some things We breathe air Magnets pull some things Sound travels Water evaporates and can change forms	Blow up balloons Observe things moved by wind Cook different foods observing changes Listen to and identify sounds Collect different soil samples
Our earth and universe (astronomy) The moon, sun, and other stars are in the sky People have put satellites in orbit around the earth People have traveled into outer space Stars move in the sky Sun gives light and heat Earth is composed of water and soil There are different kinds of soil	College pictures of where heat comes from Collect pictures of how water is used in the home Observe and measure shadows at different times of the day Compare objects left in the sun and those in the shade
Humans and our environment (ecology) Humans use plants and animals for food and clothing We use and control light We use and control heat	Prepare foods obtained from animals/those obtained from plants Collect pictures of how we use light in the home College pictures of how we use heat in the home

Be responsive to the child's interests as you create this new curriculum. As you provide activities on space, respond to the child's questions. At lunchtime, have the children identify the types of food that they are eating, whether or not it could be eaten in space. During outdoor play, have the children observe the types of plants, insects, rocks and leaves that are outside and whether they could be found on the moon or another planet. They can also observe the weather conditions. The science of space differs from the science on earth and the children need to begin to see those differences as mentioned. Continue providing experiences to encourage them to question, "How is living in space different from living on earth?" Consider the following three areas in encouraging these experiences.

The environment must be taken with you. There is no food, water, air or temperature in space. Spatial relationships change as we live in our new environment. Disorientation occurs in space. Up and down don't exist because of thc absence of gravity. Weightlessness is a concept that will be difficult to understand, but awareness of the concept of gravity and how it affects our life will be emphasized through activities in this book.

> *"Aeronautics and space activities are unique in their ability to capture the interest of young people. This natural curiosity, when properly nurtured, fosters unparalleled educational achievement. NASA is working hard to use its research at the cutting edge of technology to inspire the creative genius of young Americans. Ours is a special responsibility - to encourage children to believe in themselves, to challenge the bounds of knowledge, and to turn their dreams into the accomplishments of tomorrow."*
>
> Richard H. Truly
> Astronaut
> Pilot, STS 2
> Commander, STS8
> Former Administrator, NASA

References:

Georgia Department of Education, *Basic Curriculum Content*, Atlanta, Georgia, 1985

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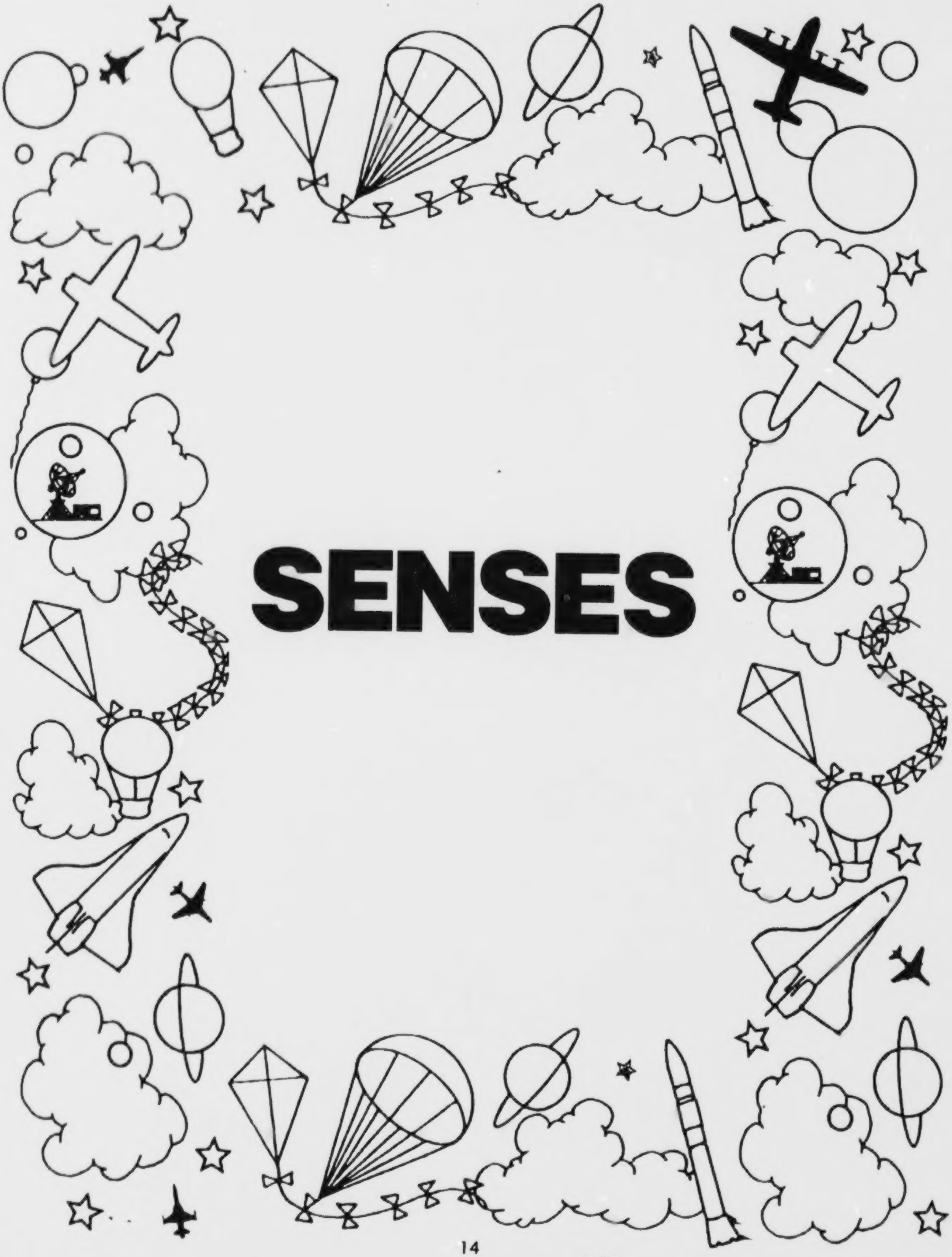


SENSES

SENSORY LEARNING EARLY CHILDHOOD

Experiences in aerospace should be integrated throughout all developmental areas: physical, social, emotional and intellectual (math and science are emphasized in this book). Children feel good about learning space concepts. The activities in this book will get the teacher started in creating an exciting environment for the child to explore physically and mentally through his senses. Activities can be individual or group, depending on the development and interest of the child. Social skills will be enhanced as the children play the activities together. Cognitive development is based on language development. Experiences such as field trips, dictating language experience stories, seeing charts and pictures, participating in dramatic play and drawing and copying are suggested to enhance cognitive development. All these experiences are learned through the child's senses. Activities in this book are designed as sensory experiences and the following information on the senses is provided for background information.

SIGHT

The eye is our most important organ for finding out about the world around us. We use our eyes to enjoy things around us and help us carry on daily activities. We see the different properties of objects and learn to classify them, compare them, and group them, thus helping us to understand our world better. The eyes are like cameras and can set themselves automatically for light, speed and distance. The eye is made up of three layers. The retina is the inner layer of the eye and is sensitive to light and color. The cornea is the front part of the eye's two outer layers. It is clear and permits light to enter the eye. The pupil is the opening in the middle layer--it is the black spot. The iris is the thin curtain of tissue which is in the front of the lens. Eyes also have eyebrows over them and eye lashes around them. The eyebrows and eyelashes are made of tiny hairs that keep dust from falling into the eye. Eyes have eyelids that close over the eyes to keep out the light and dust. Very young children can have their eyes checked with an E chart (which shows the directions in which the letter is pointing) to see whether or not glasses are needed.

HEARING

The ear is a delicate organ that can be easily damaged by infection or injury. We should be careful not to put anything in the ear or we could become partly or completely deaf. Our ears help us learn to talk. We hear high and low, loud and soft sounds. Sounds are caused by something moving back and forth very fast called vibration. A vibration uses sound waves in the air. We cannot see sound waves but we can see what causes them. When wind blows over the leaves, we can hear a sound. The eardrum in each ear starts to vibrate when a sound wave hits it. The eardrum causes three little bones to vibrate. The nerves in our ears pick up the vibration and carry the messages to the brain. The parts of the ear are: eardrum, inner ear, middle ear and outer ear. The three small bones are found in the eardrum and called the hammer, anvil and stirrup.

SMELL

Smell is one of the most important senses in man or animal. Like sight and hearing, smell gives us information about our environment. The nose must come into contact with an odor. The olfactory cells are the tiny hairs on the upper part of our nose. Nostrils are the two little openings at the end of the nose. Air goes up the nose and into the head. When it gets into the head, you can smell it. There are three basic types of odors. They are difficult to identify and organize. They are: flowery, fruity and burnt odors. Smell helps us distinguish one food from another and taste the food.

TASTE

Our tongue helps us tell one food from another. The taste buds are bumps on the tongue. They include sweet taste buds on the front of the tongue, bitter on the back of the tongue and salty and sour taste buds on the sides of the tongue. We learn to organize foods and drinks by the way they taste. Sweets, i.e. candy, cakes, ice cream, are identified by the front of the tongue. Salty items, i.e. pretzels, are identified by the front side of the tongue. Sour items, i.e. lemons, are identified by the back side of the tongue. Look at your tongue. Can you see that the taste buds on the front of the tongue are smaller than those at the back of the tongue?

TOUCH

Touch is the sense which gives us the sensation that we have come into contact with an object. We learn the shape, and softness or hardness of an object by touching it. Touch is pain, pressure, smooth, soft and hard. The senses are in the muscles and bones. We can feel with any part of our bodies. We can find out about objects by feeling similarities. Different parts of our bodies are more sensitive to touch than other parts. We can organize things by the way they feel. The feeling of pressure has the biggest number of sense organs. It is more developed on the tip of the tongue and least developed on the back of the shoulders. Finger tips and the tip of the nose are also sensitive areas. Nerve endings form small discs, just inside the living layer of the skin. These nerve endings are around each of the hairs on the skin.

References:

Hodges-Caballero, Jane *The Handbook of Learning Activities for Young Children*, Humanics Limited, Atlanta, Georgia, 1980

"Integrated Components of Appropriate and Inappropriate Practices for Four and Five Year Old Children " *Young Children*, September, 1986

EXAMPLES OF VARIOUS ACTIVITIES IN THIS TEXT KEYED TO THE SENSES

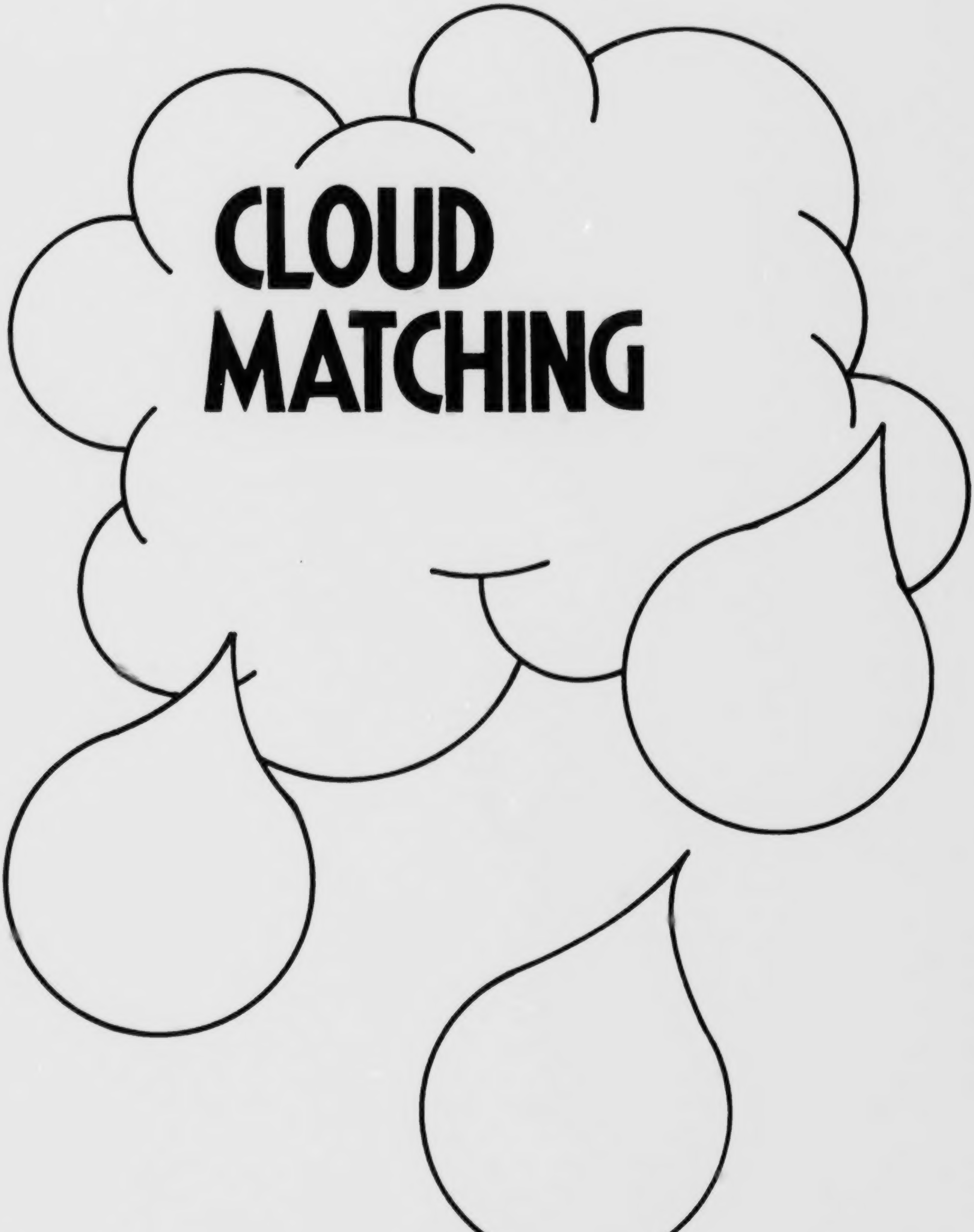
Note: The Chapter heading is followed by the number of the procedure that correlates to the 'sensory activity'.

Sight:	
Perspective	Space shuttle 4
Objects in the sky	Clouds; Constellations 1,2,PE; Solar system 1-4, PE; Moon PE
Photography (magazine photos, revisualization)	Balloons 2; Collage; Puzzles; Pilor 3-4-6; Airport Jobs 1; Aerospace Pioneers 2; Space Suit 2; Bulletin Board
Intensity of Light (light from stars)	Constellation 1,2,4, PE; Solar system 4, PE; Space Sensations PE
Hearing:	
Loudness; softness	Space Mail (initial sounds); Space Sensations 3
Dirctionality	Rocket 1,2 (up-down); Pilot 2 (traffic pattern)
Pitch and tone	Pilots (aircraft departures)
Vibration of sound	Balloons 4
Noise	Rocket 1, Space Sensations 3
Smell:	
Food	Space Food 1-6, PE
Hygiene	Space Suit Background, Space Sensation Background
Taste:	
Food preference	Food 1-5, Parent Experience, PE
Water content	Food 1-5
Kinds of food	Food 1-5
Size, shape, color	Food 1-5, PE
Touch:	
Temperature	Clouds 1-4, Weather 1 1-6, Space Suit, PE
Textures	Balloons 3, Solar System 1 (paper mache); Clouds 3; College PE; Moon 3, Parachutes PE
Clothing	Space Suit 1,3, PE
Grip	Balloons PE; Flight 1-3, 4; Kites; Parachutes; Pilots 5,6; Rockets 1,3, PE; Rocket 2,3; Puzzles
Vibration	Space Sensations 1; Pilot (airplane takeoff)
Movement	Space Sensation 1-4, Background; Space Station 4; PE; Movement. Poems- Trip to the Moon, Astronauts, Rocket, Solar System

STOP

concept introducing pages are to be used by the teacher for folder game covers. They are not to be used for "ditto" coloring sheets for the children.

CLOUD MATCHING



NAME: Clouds

SUBJECT/SENSE: Science (Sight, touch)

SKILL: Become aware of various cloud forms

PROCEDURE:

1. Clouds are vaporous formations in the sky. They can be made in the following way: Put water in the teakettle, let the water in the teakettle come to a boil. Watch the escaping vapor condense as it rises and cools, forming a small cloud. Share the observation encouraging the children to tell what happened.
   Materials: stove or hotplate, teakettle, water

2. Pour two to three inches of hot water in a jar. Cover jar with the lid. Put three to four ice cubes on the lid and watch the clouds form. Share the observation encouraging the children to tell what happened.
   Materials: jar, water, ice cubes

3. Provide the children with cotton balls, blue construction paper and glue stick. Encourage the children to tear the cotton apart and create cumulous (puffy), stratus (layers) and/or cirrus (curly, featherly) cloud formations, then glue the formations to the paper. Children may vary this acivity by making cloud pictures from the various shapes.
   Materials: cotton balls, blue paper, glue stick

4. The teacher can beat a mixture of 2 cups Ivory soap powder and I 1/4 cups water. The children can fingerpaint and form clouds on blue construction paper.
   Materials: Ivory soap, water, bowl, beater (fork), blue construction paper

5. The teacher will create the folder game activity on the following page. Attach a brad next to all cloud formations. Wrap a string around the brad on the left column. Allow the children to match the clouds by wrapping the string around the brad on the right column.
   Materials: folder, pattern, glue, brads, string

6. Large pipes spray water below the Space Shuttle on the launch pad to help absorb the sound of the rocket engines at blast-off. The Space Shuttle makes a great big cloud when it blasts off. The flames from the engines heat up the water around the Shuttle creating a giant cloud. Look at NASA photos of the Space Shuttle launch so the children can see the big clouds.
   Materials: photograph of Space Shuttle launch

PARENT/CHILD EXPERIENCE:

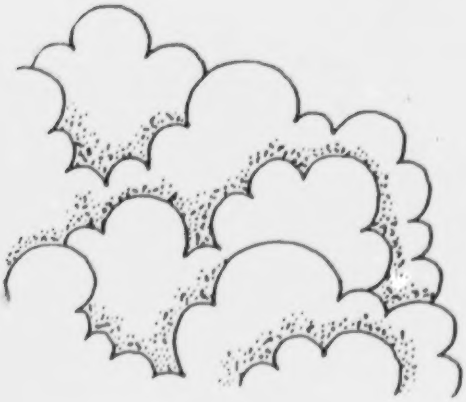
Go outside and look at the clouds with your child. Ask your child what he thinks the clouds mean. If some clouds look darker than others ask your child if he knows why some clouds look darker than others. If there is a dark or thicker cloud (it is more dense allowing less sunlight to pass through) it probably means it is going to rain because it has more moisture in it. Ask your child to talk about how the rain sounds.

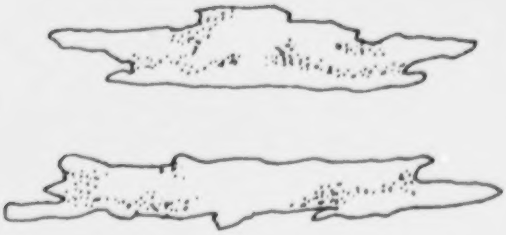
OBJECTIVE: Observe various clouds

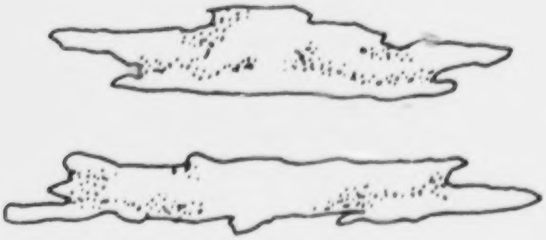
BACKGROUND INFORMATION:

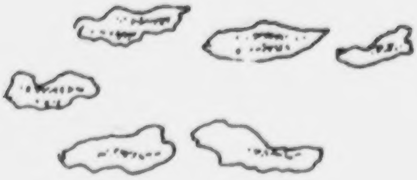
There are no clouds in space; however, it is very important to learn about them if you are going to travel in air or space because a pilot can't tell if he is up or down when he flies into a cloud. Cumulous clouds are near the earth's surface or can tower thousands of feet in the sky. Stratus clouds form in layers like fog and are seldom above 6,500 feet. Cirrus clouds are in the top level of the atmosphere (troposphere) which is below 50,000 feet. Space is above the earth's atmosphere, (troposphere) where there is no moisture or air that is needed to form clouds.

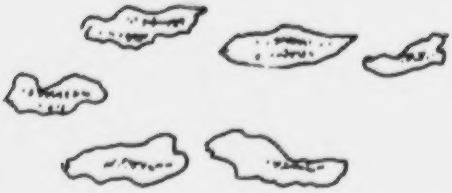
MATCH THE CLOUDS

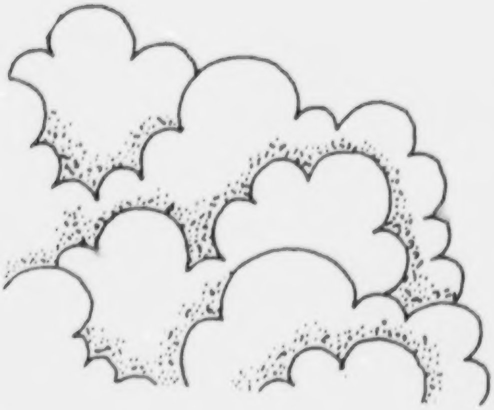


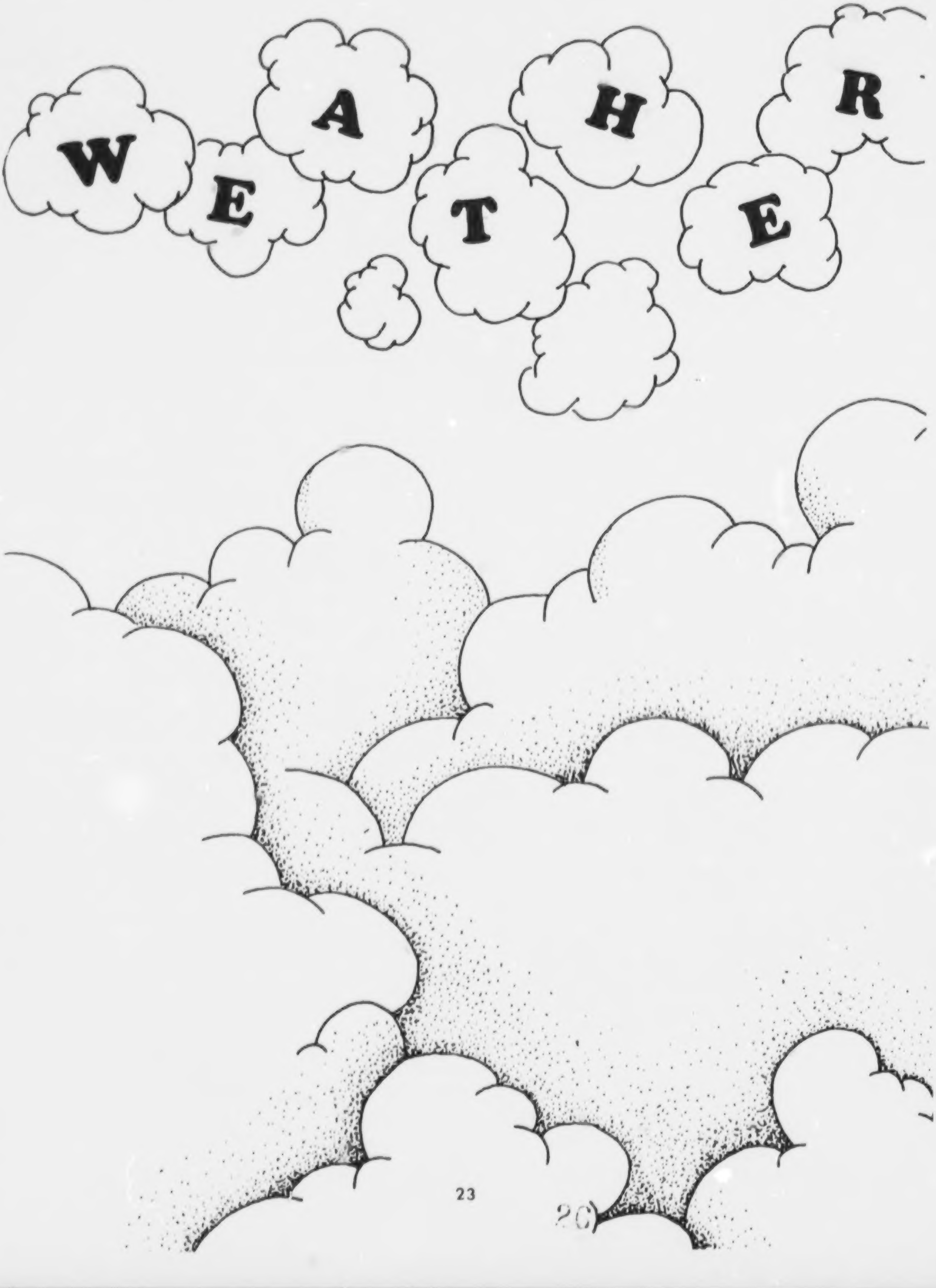












WEATHER

NAME: Weather

SUBJECT/SENSE: Science (Sight, touch)

SKILL: Become aware of weather (rain and air) and that weather changes

PROCEDURE:

1. The teacher will make the folder game on the following page. Discuss the seasons with the children and that certain symbols represent certain types of weather--snowman with snow represents cold weather; umbrella represents rainy weather, a kite represents windy weather; and the sun represents hot weather. Then ask the children to match or say the word that represents the weather symbol.
   Materials: Folder, pattern, glue, markers, scissors

2. To show how air will cool as it expands outward and upward, ask the children to put their hand close to their mouth and blow out. Then ask them to hold their hand about eight inches away from their mouth and blow out (exhale). Ask the children if they could tell a difference in the air as it struck their hand at different distances from their mouth.
   Materials: None

3. Pour water into two different glasses. Place a thermometer in each glass. Place one glass in a shady spot and one glass in direct sunlight. Have children observe the mercury in the thermometer rise to a higher temperature in the sunlight than the one in a shady spot. This will demonstrate how sunlight gives us heat. They can also put their finger in the water to feel the differences in temperature.
   Materials: two glasses, two thermometers, water

4. Discuss the weather equations with advanced children. They will learn the symbols that represent sun, air, moisture (rain), rotation.
   Materials: folder, pattern, glue, markers, scissors

5. To find out how much it rained during a downpour, the teacher will help children to mark one-half inch lines along a piece of masking tape using a ruler. Attach masking tape vertically along a jar. Place jar outside in an open space. Look at the jar and measure how much it rained.
   Materials: jar, masking tape, market (pen), ruler

6. The teacher will light a piece of paper and drop into a glass bottle (the neck should be a little smaller than an egg). Put a moist-shelled hard boiled egg on top of the

glass bottle. The egg will fall into the bottle because air expands when hot and contracts when cool. To remove the egg have child blow into inverted bottle, the egg will fall out due to change in air pressure. Materials: hard boiled egg, glass bottle, paper, match

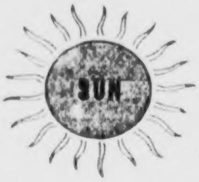
PARENT/CHILD EXPERIENCE:

Hot air expands. This can be demonstrated by the following experiment. Blow up a balloon. Tie it with a string. Tie it to a hot radiator or near a sunny window. When the balloon gets hot, it will burst because hot air expands. Ask your child to tell what happened. Materials: Balloon, string

OBJECTIVE: Observe hot air expanding

BACKGROUND INFORMATION:

Space weather satellites have found out that there is no weather in space because there isn't any air or water. Weather satellites have provided tremendous knowledge about the current and predicted weather. Millions of lives have been saved because of more accurate weather predictions. It is very important to understand weather before blast-off into space. Spacecraft have to blast-off in good weather and it must be predicted that the weather will be good upon reentry. Depending on weather conditions the Shuttle will land at Kennedy Space Center in Florida or Edwards Air Force Base in California. Discuss with your children how they would feel about living in space without weather changes.

Because the Earth is warmed by the , surrounded by an ocean of , supplied with and as it travels in space, we have many changes in our weather. Changes in the weather are important to pilots because they want to operate their aircraft safely. Sometimes the Space Shuttle did not take off or land because of bad weather.

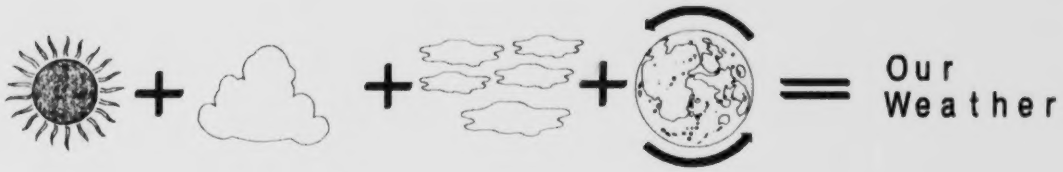
THINK ABOUT THE WEATHER

1. Is there weather on the moon?

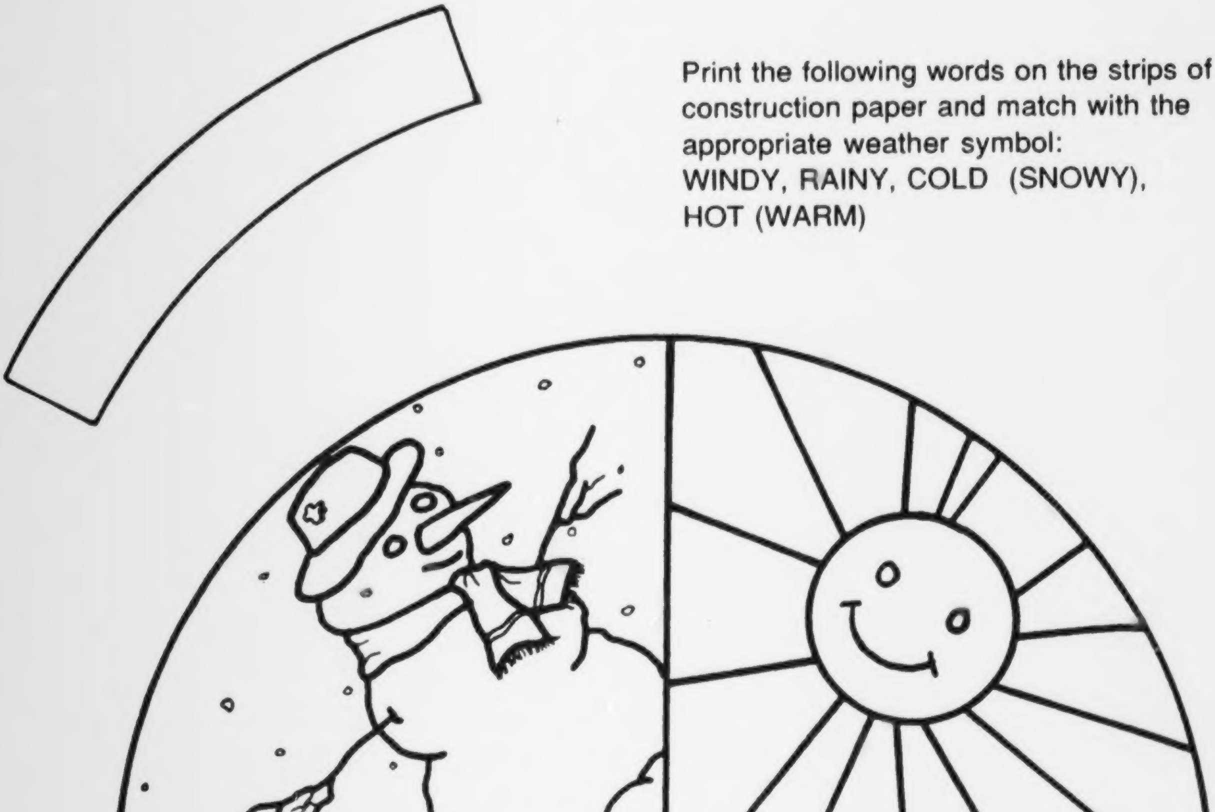
2. Why or why not?

3. Why is knowledge of the weather important to a pilot ?

4. Complete this equation:



Print the following words on the strips of construction paper and match with the appropriate weather symbol:
WINDY, RAINY, COLD (SNOWY),
HOT (WARM)



ANSWERS
1. No
2. The moon has no air or water.
3. The pilot wants to operate his plane safely and efficiently.
4. A. Sun, B. Air, C. Water, D. Rotation of Earth.

CONSTELLATIONS

NAME: Constellations

SUBJECT /SENSE: Science (Sight), Math (touch)

SKILL: Identify stars and that stars give off light and count to seven.

PROCEDURE:

1. The teacher will read the story about the Big Dipper then tell the children about the Big Dipper. Ask the children to count how many stars are in the Big Dipper. Allow the children to use stick-on stars to paste on top of the formation of the Big Dipper (one-to- one correspondence).
   Materials: folder, pattern, glue, stick-on stars

2. The sun is our closest star. Color comes from light and sunlight is made of many colors. Show that sunlight is made of all colors of the spectrum using a prism. The prism bends the light and divides the colors into separate sections. Children can name the colors.
   Materials: prism (crystals)

3. Turn on a flashlight in a darkened room and outside in the bright sunlight. Ask the children to tell which light is brighter. This will illustrate to the childrcn that stars are seen only at night because the sunlight is so bright during the day that you cannot see the stars.
   Materials: flashlight

4. The teacher can cover a paper towel or toilet paper tube, including one end with tin foil. Punch holes in the end with a small pointed object. The child can hold the toy telescope up to the light seeing the "stars" and singing "Twinkle, Twinkle, Little Star" or "Star Light, Star Bright."
   Materials: paper towel, toilet paper tube, tin foil, any pointed object

PARENT/CHILD EXPERIENCE:

Go outside and observe the constellations with your child on a clear night. See if you can locate the Big Dipper.

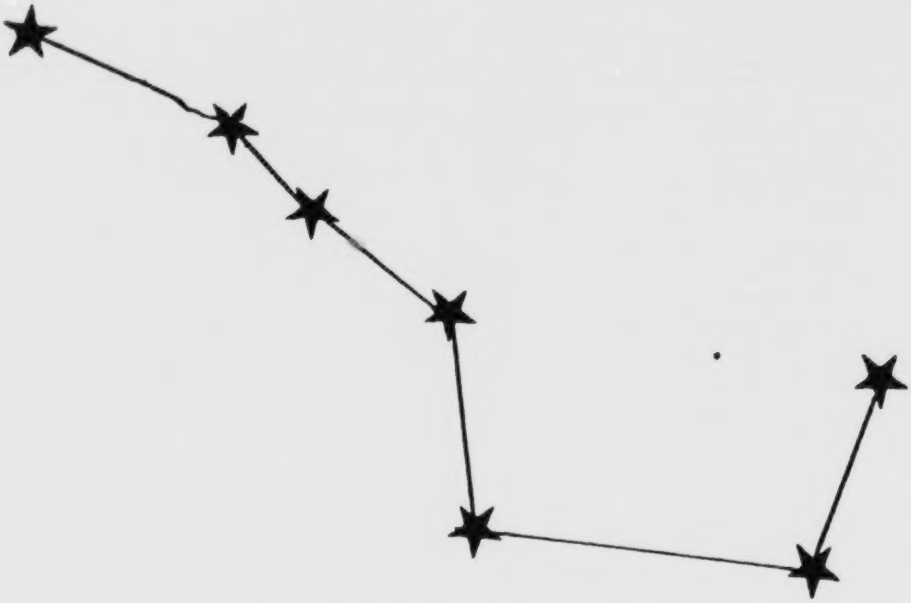
OBJECTIVE: Observe stars in the sky

BACKGROUND INFORMATION:

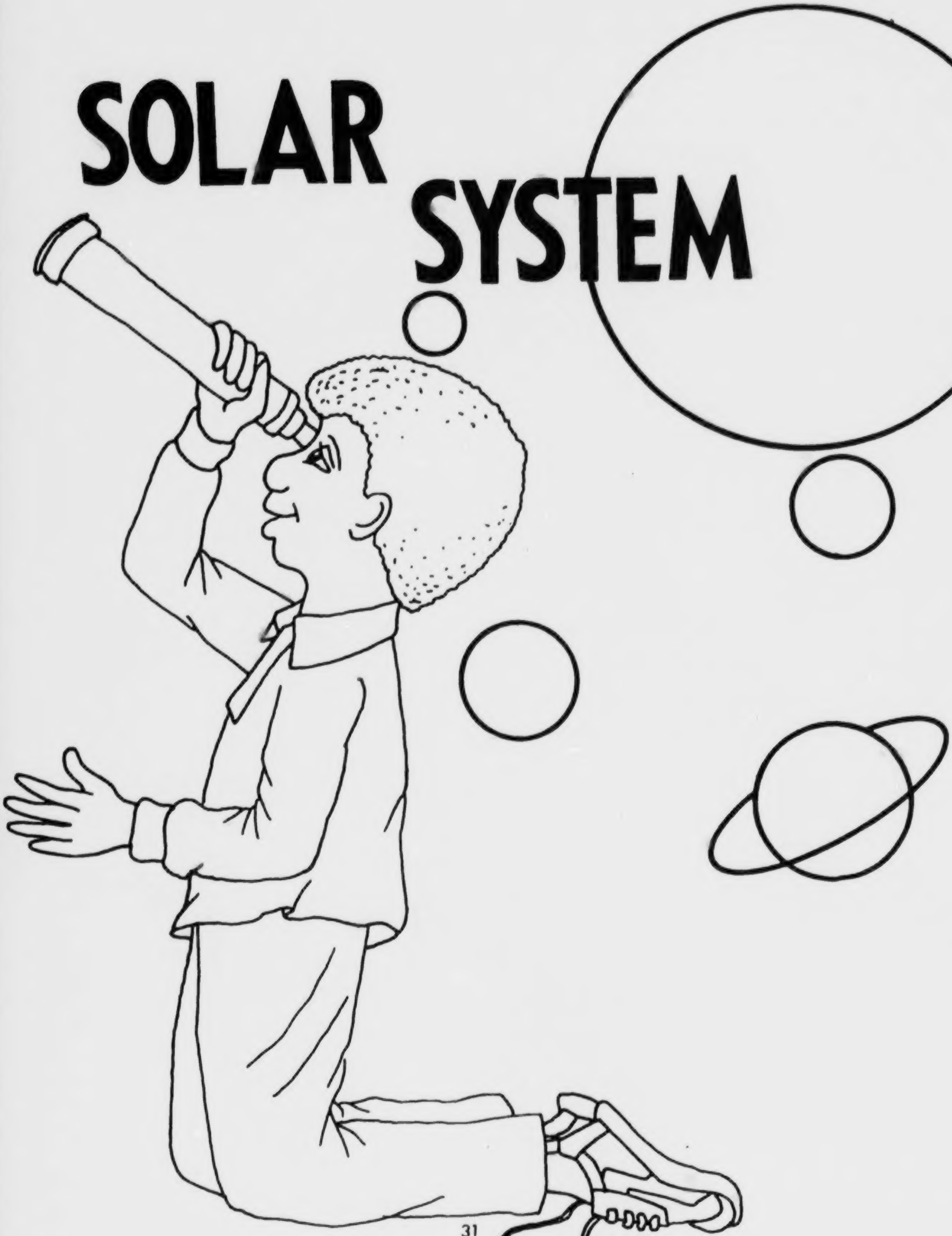
Stars can be seen better in space and they do not twinkle because you don't have to look through the earth's atmosphere. (In fact, you can see 25 times better!) Stars help the Space Shuttle pilot know his position. He can look at the North Star and relate to his position on earth. Stars actually created their light years ago because light travels at 186,000 miles per second. The light that we presently see from the sun left the sun about 8 minutes ago.

THE BIG DIPPER

The most recognizable constellation in the Northern Hemisphere is the Big Dipper. It is shaped like an old-fashioned water dipper. (The Big Dipper is part of the Great Bear, a larger constellation). The Big Dipper contains seven stars. The middle stars of the handle (Alcor and Mizar) appear to be a double star. The two outer stars of the bowl point to the North Star (Polaris). Since a magnet does not work in space, the North Star helps pilot-astronauts determine their position because it is always in the north.



SOLAR SYSTEM



NAME: Solar System

SUBJECT/SENSE: Science (Sight)

SKILL: Become aware of the solar system (there are planets and a sun in the sky and that we live on one of the planets called Earth); the Sun gives us heat and light.

PROCEDURE:

1. The teacher will assist the children in making a solar system out of paper, balloons, paper mache, or styrofoam balls. The teacher will arrange the planets in correct orbital position as the children count the planets. Strings can be attached to "planets" and hung from a coat hanger.
   Materials: Nine balloons, nine paper mache balls or nine styrofoam balls, coat hanger, string (if paper mache or styrofoam is used children can use tempera paint, water and brushes to paint the planets.)

2. The teacher will create the folder game activity on the following page. She will color two sets of planets to match. She will laminate one set on file folder in correct orbital position. The teacher should number the planets on the back of the second set so the children can arrange the planets in number sequence. The children will match the color and size of the circles.
   Materials: folder, pattern, glue, scissors, markers

3. The teacher will read the poem to the children and then have them repeat the poem.

Planets

Mercury, **V**enus, **E**arth and **M**ars, these are the planets that dwell near the stars.
Jupiter, **S**aturn, **U**ranus, too, **N**eptune and **P**luto, I know them, do you?

My **V**ery **E**ducated **M**other **J**ust **S**erved **U**s **P**istachio **N**uts (After 1999 the planets will return to the regular order so use **N**ine **P**izza pies.)

Earth

The earth is a great big ball (Make round circle with hands) It isn't flat at all (Hold palms together) It spins around like a top (spin finger) It never ever stops (shake forefinger)

4. Use a flashlight to represent the sun and styrofoam balls to represent the planets. The teacher will shine the flashlight as the children rotate the planets slowly on their axis (their hands) and orbit (walk around the sun). The children will watch how the sun gives the planets light.
   Materials: flashlight, styrofoam balls

PARENT/CHILD EXPERIENCE: Go outside with your child at different times during the day. Watch the effects of the sun casting a shadow at different times of the day. This will show your child how the sun changes the amount of heat and light provided during the day.

OBJECTIVE: See that the sun gives us heat and light as it shines on earth

BACKGROUND INFORMATION:

The Space Shuttle and NASA satellites are exploring our solar system. The sun is the center of our solar system and the planets revolve around the sun. Space probes (satellites) have visited other planets. Pictures of the planets can be obtained from NASA. (See Resources)

Mercury--closest to the sun; yellow in color; life as we know it isn't possible because there is no air or water and its too hot or too cold depending on which direction it is facing.

Venus--closest to the size of the earth; life isn't possible as we know it; we call it our morning or evening star

Earth--only planet that has life on it; one moon; length of each day is twenty-four hours

Mars--two Viking spacecraft landed on Mars in July and September, 1976, found rolling dunes of orange dust and volcanic rocks; water may have been on Mars about a billion years ago or may be underground; took many exciting photographs and performed many experiments

Jupiter--Pioneers 10 and 11 spacecraft visited Jupiter March 1972 and April 1973; discovered rings; largest planet with 16 moons

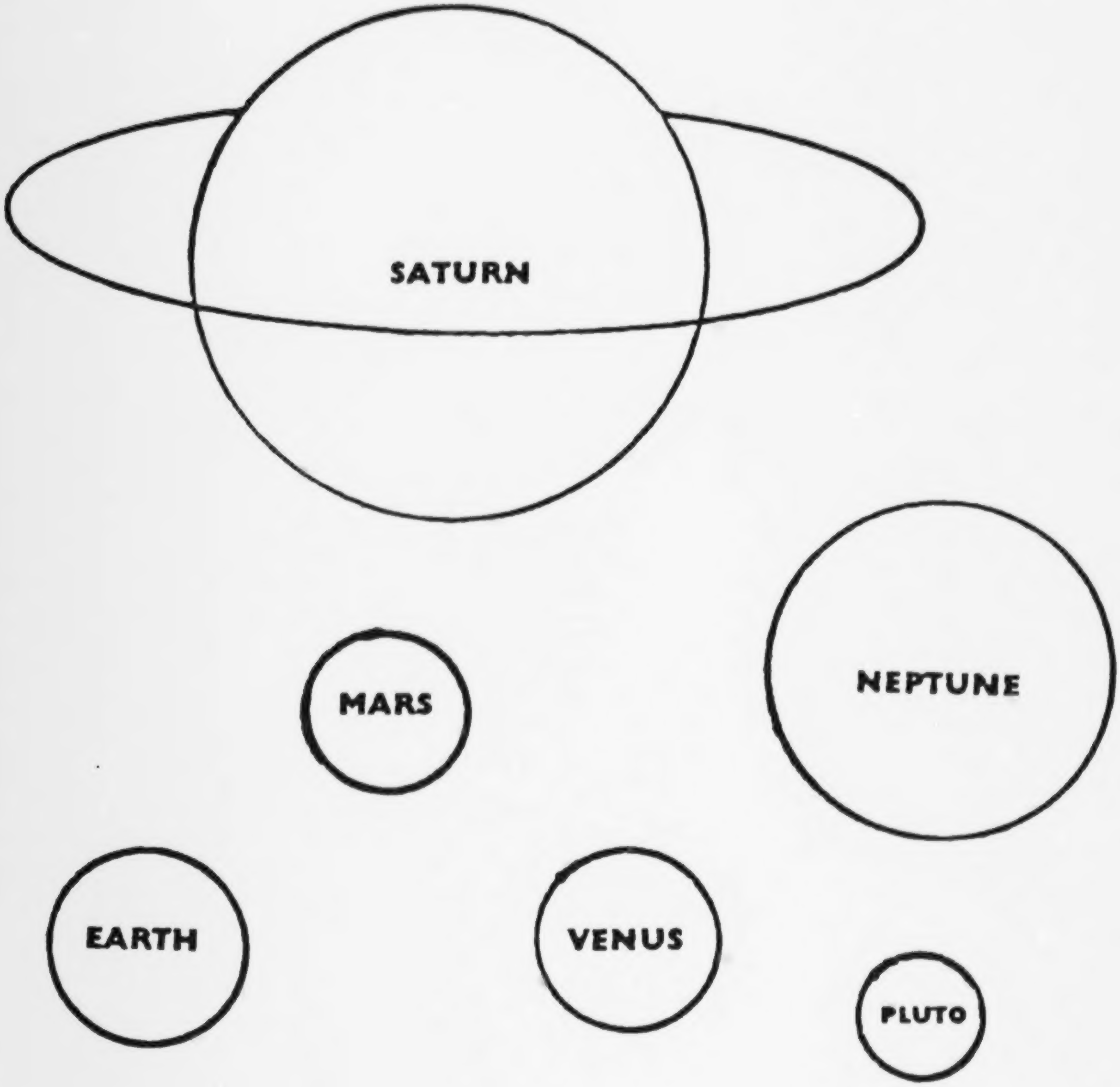
Saturn--Voyager spacecraft verified 18-21 moons and over 1000 rings on a recent visit to Saturn

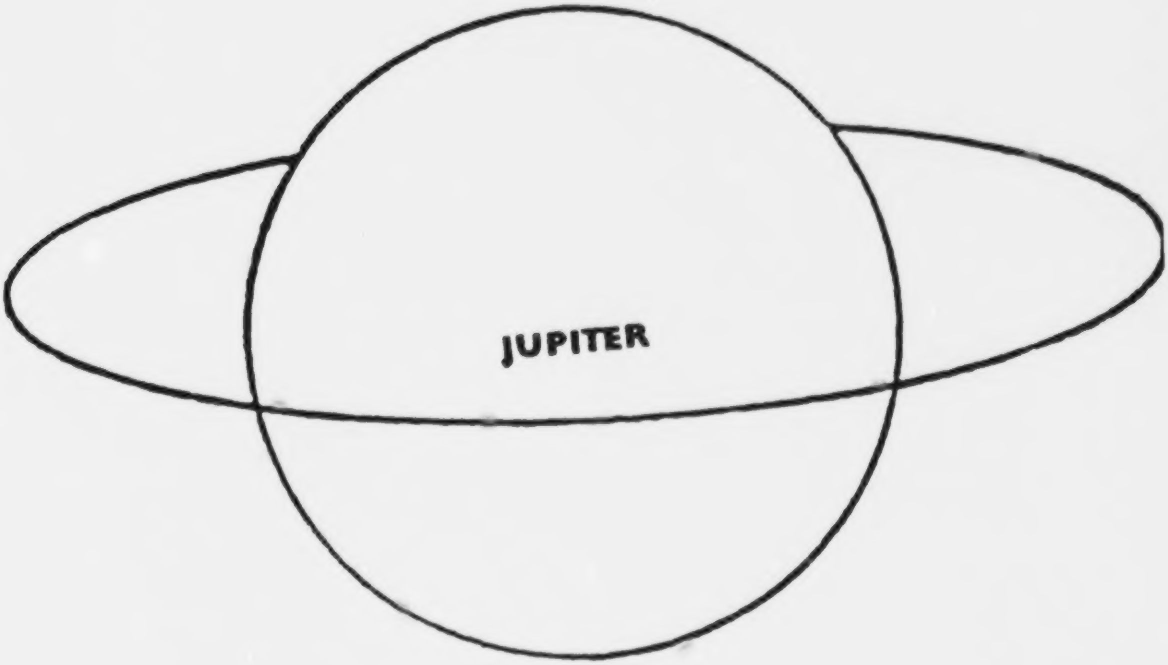
Uranus--The Uranus Encounter, by Voyager II discovered ten additional satellites, bringing the total number of satellites (moons) to fifteen, verified ten rings around Uranus; green in color

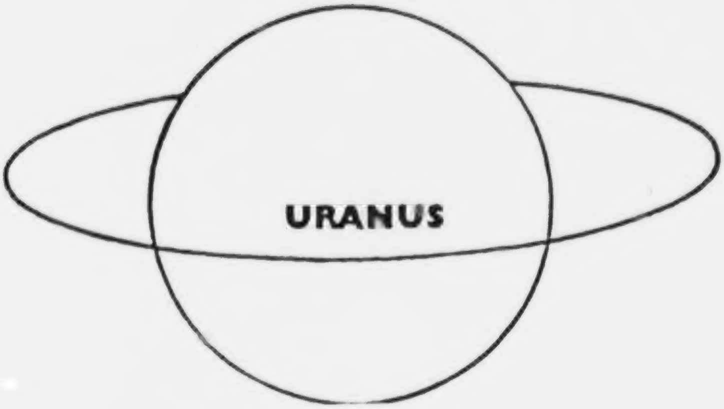
Neptune--Voyager II spacecraft visited Neptune last; has two moons that go in opposite directions

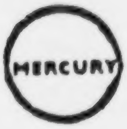
Pluto--Orbit is inside Neptune untill 1999; one moon called Charon

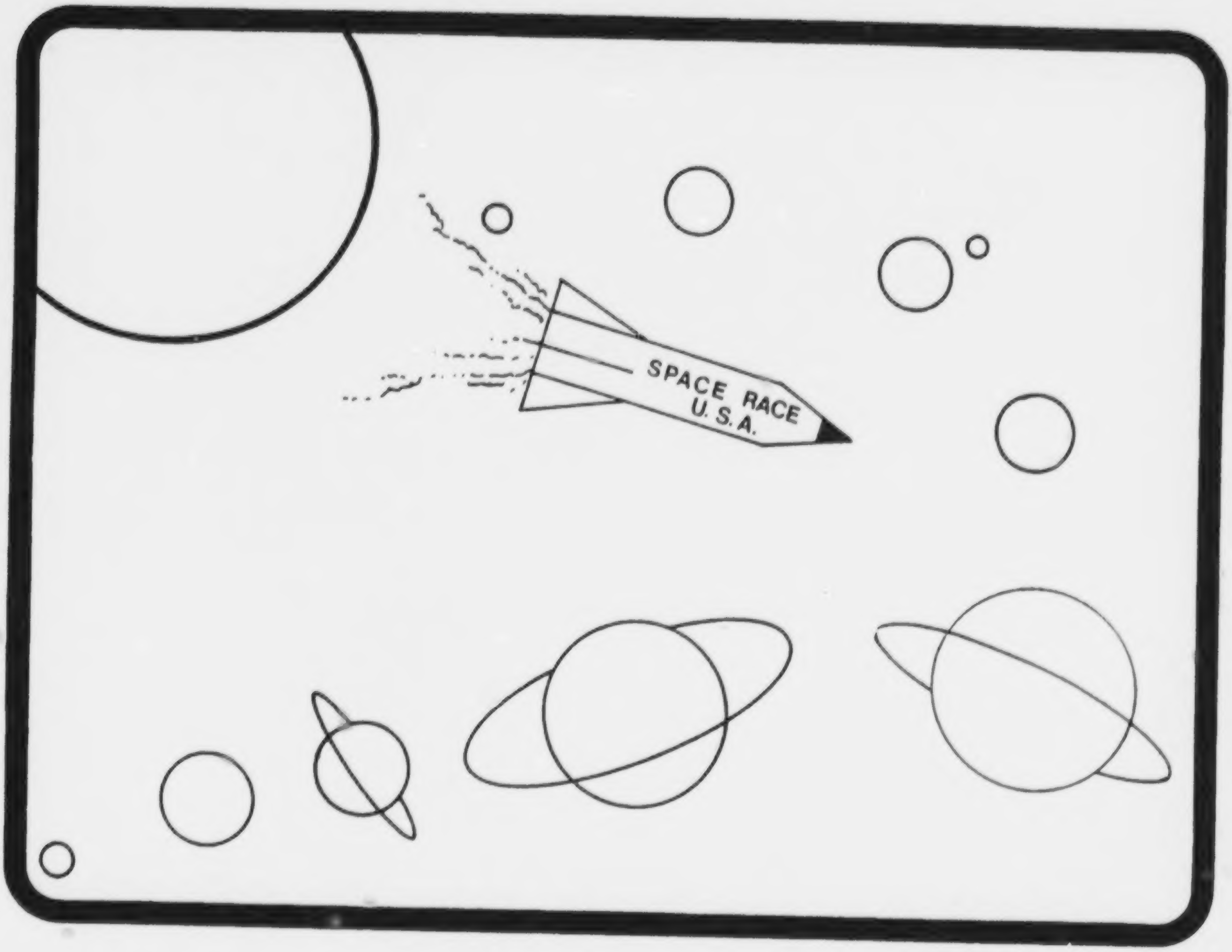
PLANETS


SATURN
MARS
NEPTUNE
EARTH
VENUS
PLUTO


JUPITER


URANUS


MERCURY

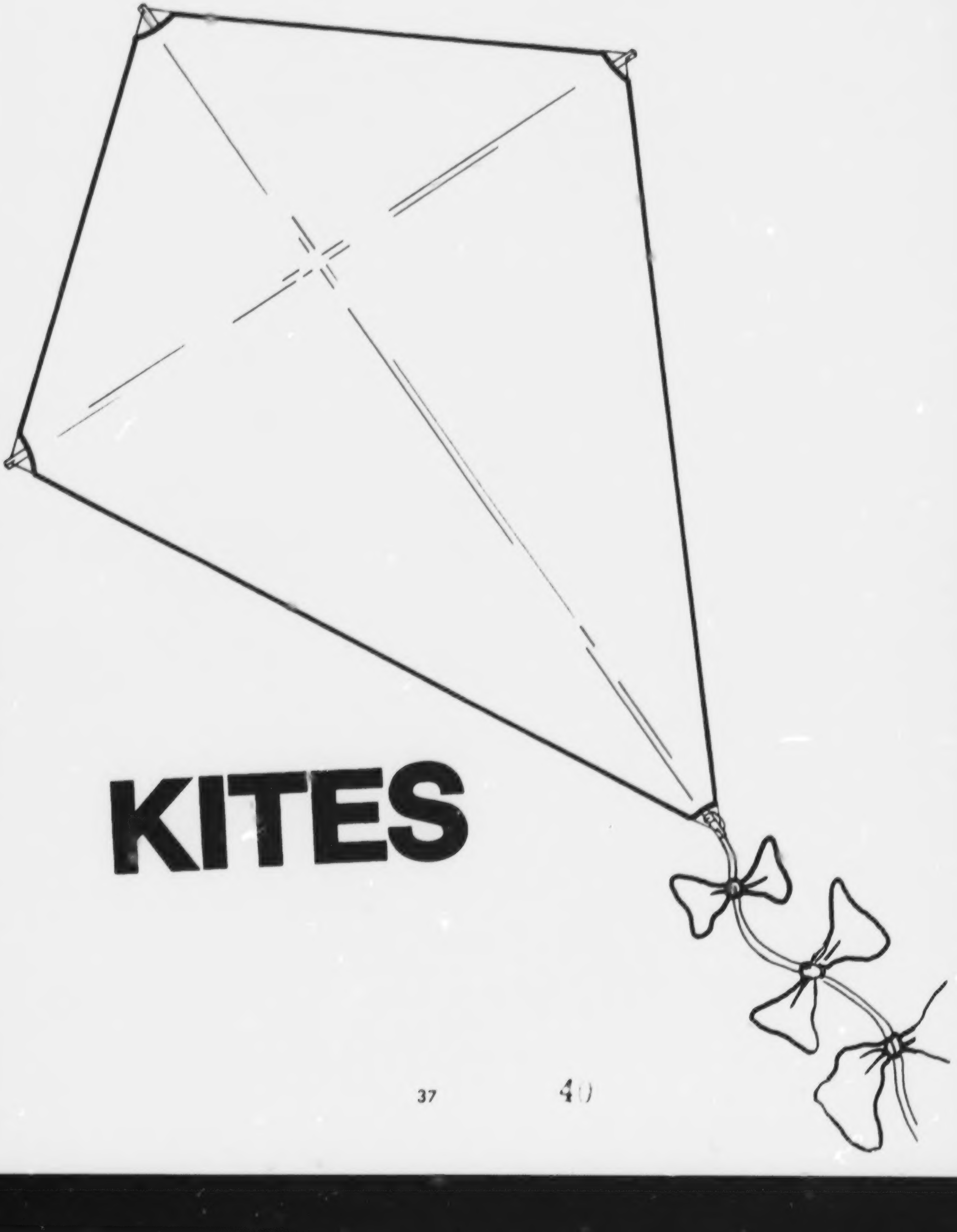


Directions:

1. Roll the die to see who begins. High number starts.
2. Each player gets one roll of the die.
3. The first player to travel through the solar system wins.

Roll:

1. Color the sun.
2. Label the smallest and closest planet to the sun.
3. Label Venus, the planet covered with clouds.
4. Color the Earth and label it.
5. Color Mars the red planet.
6. Color the largest plantet, Jupiter, and put a red spot on it.
7. Color the rings around Saturn.
8. Label Uranus and make 15 tiny moons around it.
9. Neptune is similar to Uranus, color it the same.
10. Draw one moon around Pluto.



KITES

NAME: Kites

SUBJECT/SENSE: Science (Sight, touch)

SKILL: Become aware of the effects of moving air, wind, on an object; visually discriminate through matching

PROCEDURE:

1. The teacher will have the children make their own kites using two triangles (a diamond) and popsicle sticks. The children can display them on a bulletin board or hang them from the ceiling.
   Materials: two paper triangles, string or yarn, colors, markers, paints, some scrap material for a tail

2. The teacher will create the folder game activity on the following page. Attach a brad next to all kite formations. Wrap a string around the brad on the left column. Allow the children to match the kites by wrapping the string around the brad on the right column.
   Materials: folder, pattern, glue, brads, string

3. The teacher will make a sailboat with the children. Put clay or wax in a walnut shell. Glue or tape the triangle onto a toothpick and stick it in the clay or wax. Have the children place the walnut in a bowl of water and watch the effects of the boat as they blow on the triangle (sail) in different directions.
   Materials: triangle, tape or glue, toothpick, clay or wax, walnut, bowl of water

4. Talk about how kites are used by different people at different times. A long, long time ago the Chinese built kites (1,000 B.C.) The Japanese then made kites for religious ceremonies. Stories were told of men being carried by kites. Experiments were done with manned kites (19th and 20th centuries). Today many people enjoy soaring through the air with a sophisticated kite (hang-gliding).

5. Make the pinwheel using the pattern. As the child blows on the pinwheel, the effects of air will be observed.
   Materials: pattern, scissors, pin, straw, tape

PARENT/HOME ACTIVITIES:

1. The parent will read the safety rules of kite flying to their child.

2. Build and fly a kite with your child. (see directions)

Be sure and attach a tail to the kite. It keeps the bottom of the kite down providing stability. If you don't have a tail, the kite spins. The length of the tail can be adjusted to provide the stability needed.

OBJECTIVE: Fly a kite seeing the effects of air

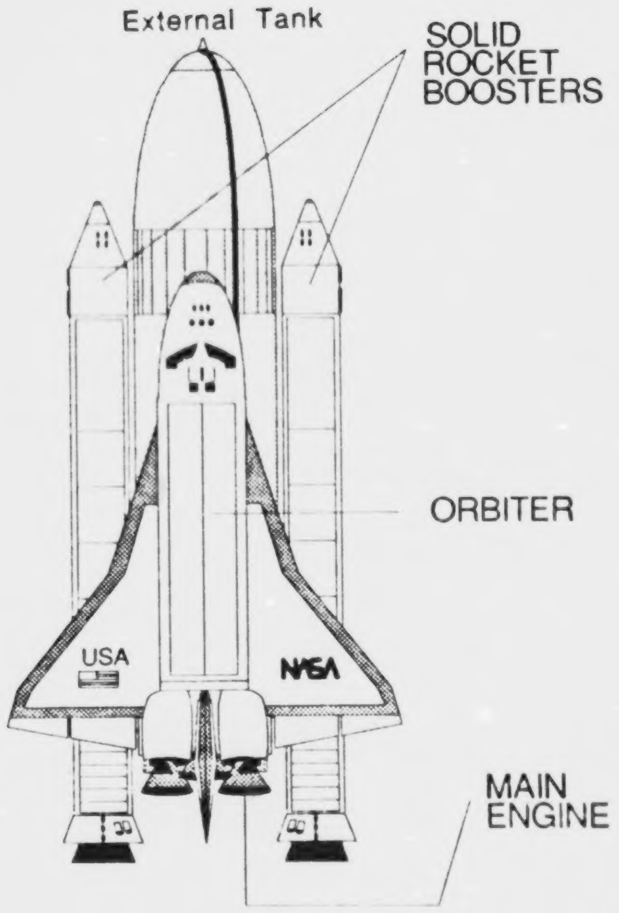
BACKGROUND INFORMATION: Children need to learn about the effects of air (airfoil) on various flying objects, i.e., kites, balloons, airplanes, helicopters. The Space Shuttle flies differently depending on where it is. It is like a rocket at blast-off, like a spaceship in space (wings have no effect in space), and like a glider with no engine when it returns to the earth's atmosphere. It is like an airplane because it has the flight controls of an airplane.

SPACE SHUTTLE

The Space Shuttle is a spacecraft that can be used for many flights into space. It carries people and experiments to Earth orbit. Scientists and engineers ride in the Shuttle and operate experiments in Space. Someday, the Shuttle may carry private citizens to Earth orbit, maybe even you.

The Space Shuttle has four major parts: The Orbiter, the Solid Rocket Boosters (two of them), the External Tank, and the set of three Space Shuttle Main Engines in the rear of the Orbiter. Only the Orbiter and the main engines go into Earth orbit. The other parts are for liftoff and powered flight.

NASA's Marshall Space Flight Center in Huntsville, Alabama, provides the boosters, the External Tank, and the main engines for the Space Shuttle.



ACTIVITY

To make your own kite, follow the directions below. The following guidelines are provided for safe, fun kite flying:

1. Fly your kite far from power lines.
2. Always use dry string, wood and paper in your kite - never use metal, wire or metallic string or cloth.
3. Don't fly your kite in the rain.
4. Don't cross streets when kite flying.
5. Always fly your kite away from antennas.
6. Always call your power company if your kite gets snagged in a power line. Do not pull the string or climb power poles.

STICK KITE

Materials 2 sticks - one 36 inches long, the other 30 inches long. Covering newspaper, tissue, plastic, cloth, almost anything on hand, kite string glue or tape

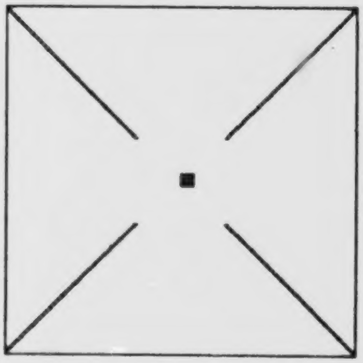
Procedure Make saw cuts or ridges in the four ends of the sticks. Lash and then glue cross stick about 9 inches from the top of the longer stick. Run string around the kite through each cut at the end of each stick and tie. Lay the frame on the covering, leaving a margin of 2 inches all around. Glue the edges down over the string.

Bridle: The bridle should be 1-1/2 times the length of the vertical stick. Attach one end of the bridle to the intersection of the two sticks and the other end to the bottom of the verical stick. Tie the flying line 4/5 of the distance up from the bottom of the kite.

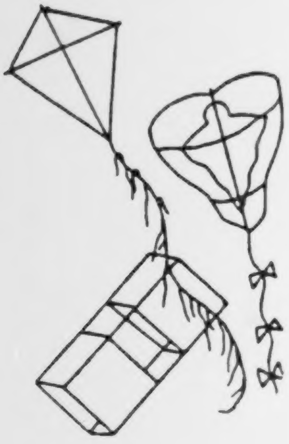
Tail: Make a tail by attaching scraps of paper or cloth to a 10 inch string.
Reprinted from NASA Fact Sheet

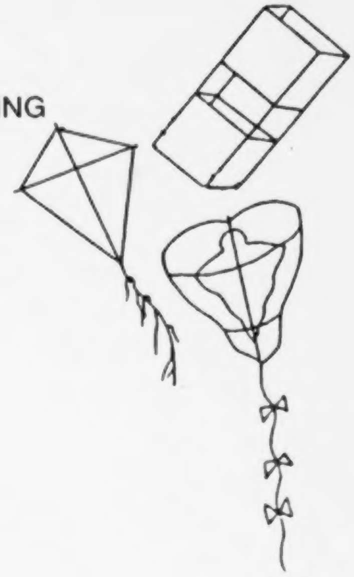
PINWHEEL

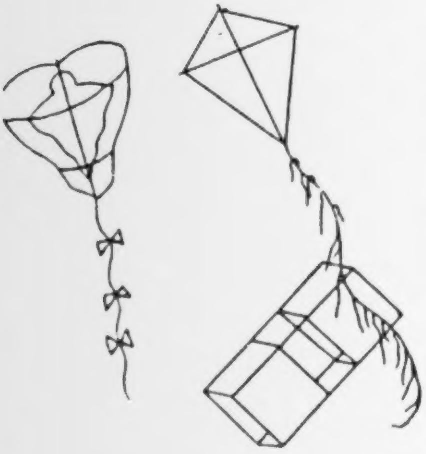
Make a pattern similar to the one shown.
Cut on solid lines.
Fold every other point toward the middle.
Stick a pin through the points and a soda straw.
Bend pin point and secure with tape.
Blow on the pin-wheel, seeing the effects of air.

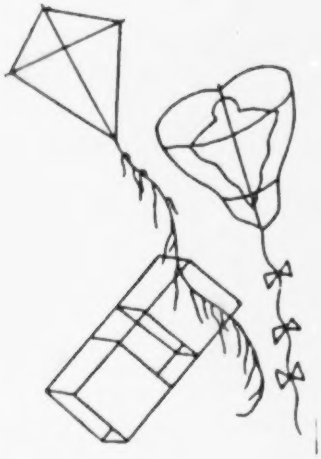


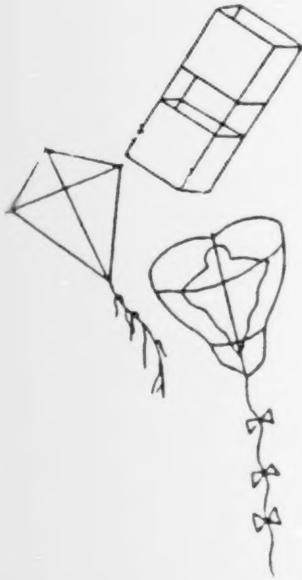
MATCH THE FOLLOWING SETS OF KITES

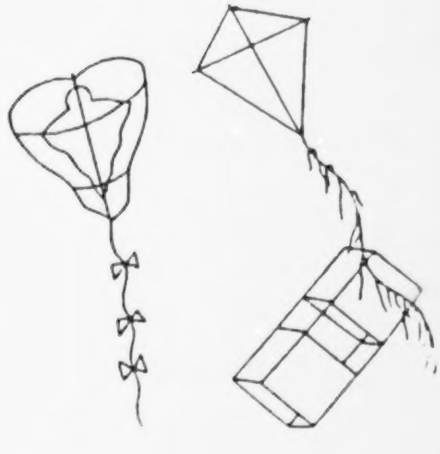












BALLOONS

NAME: Balloons

SUBJECT/SENSE: Science (Touch), Math (Sight)

SKILL: Become aware that air (wind) moves objects in the sky; create patterns

PROCEDURE:

1. The teacher can talk about the first hot air balloon to the children. Ask the children questions such as "Who were the first living passengers?" to increase listening comprehension.
   Materials: folder, story

2. The teacher can color the worksheet, creating repetitious color patterns, i.e., red, blue, red, blue, etc. Ask the children to name the colors. Then the children can color their own balloons with repetitious patterns. The teacher will color a second balloon the same color. Cut out the strips and have the children match the strips of color to the balloon.
   Materials: folder, pattern, glue, markers

3. The teacher can help the children cover a blown-up balloon with paper mache. Paint and decorate the balloon. Attach a basket at the bottom; hang from the ceiling. (See following page for directions.)
   Materials: paper mache, balloon, paint, decorations, basket, string

4. The teacher can buy a helium balloon from a mall or store. Untie the knot and inhale a little bit of the helium--then talk. You will sound like Donald Duck. Air across the vocal cords causes sound. Helium is less dense so it causes a variation in sound. The children will hear the effects of air.
   Materials: helium balloon

PARENT/CHILD EXPERIENCE:

1. Have your child blow on a dandelion (spring or fall). Have your child watch the flight of the dandelion and compare it to balloons and birds in flight.
   Materials: dandelion, balloon

2. Help your child fill one balloon with air and another with water and tie the balloons. Have your child take the two balloons outside and drop them at the same time to compare which is heavier; lighter. Explain the concept of gravity to your child--heavier objects fall faster on earth due to less air resistance.

OBJECTIVE: See the affects of air and gravity

BACKGROUND INFORMATION:

A balloon can rise because a gas is used inside the bag which is much lighter than the air around it. The earliest balloons were filled with heated air. Since hot air is less dense than cold air, the balloon would rise. There is a hole in the top of the balloon to let the hot air molecules escape making the air inside the balloon lighter. However, the air would soon cool so the ascension of hot air balloons is short. The Montgolfier brothers experimented with the first hot air balloon. Three months later they were invited to put on a demonstration for King Louis XVI and Marie Antoinette in France. They attached a cage to the balloon which contained a sheep, a rooster and a duck. The animals stayed aloft eight minutes and traveled a mile and a half. These animals became known as the first passengers in flight! Riding a balloon is a sport for many people who enjoy the thrills and adventures of floating in the air. There is much skill required in locating various currents of air and maintaining the proper altitude to fly with certain paths of air.

PAPER MACHE BALLOON

Materials

newspaper
wheat paste (consistency of whipping cream)
tempera paint and brushes
decorations (sequins, lace, ribbons, etc.)
pint milk carton
string

Procedure

Tear the newspaper into strips I inch x 6 inches
Blow up the balloon
Dip the strips into the wheat paste, wipping off excess
Cover the balloon with two layers of paper strips
Let the paper mache completely dry
Paint and decorate the balloon
Attach strings around the balloon
Attach ends of strings to milk carton
Hang balloon from the ceiling

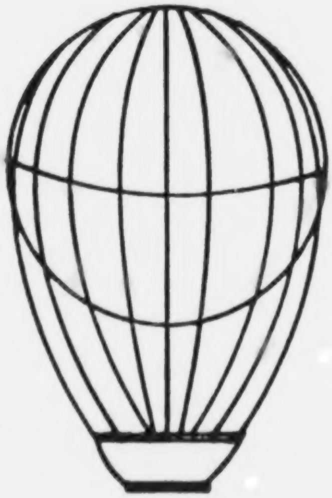
During the time that the letter "B" is presented, helium balloons with a similar message may be launched:

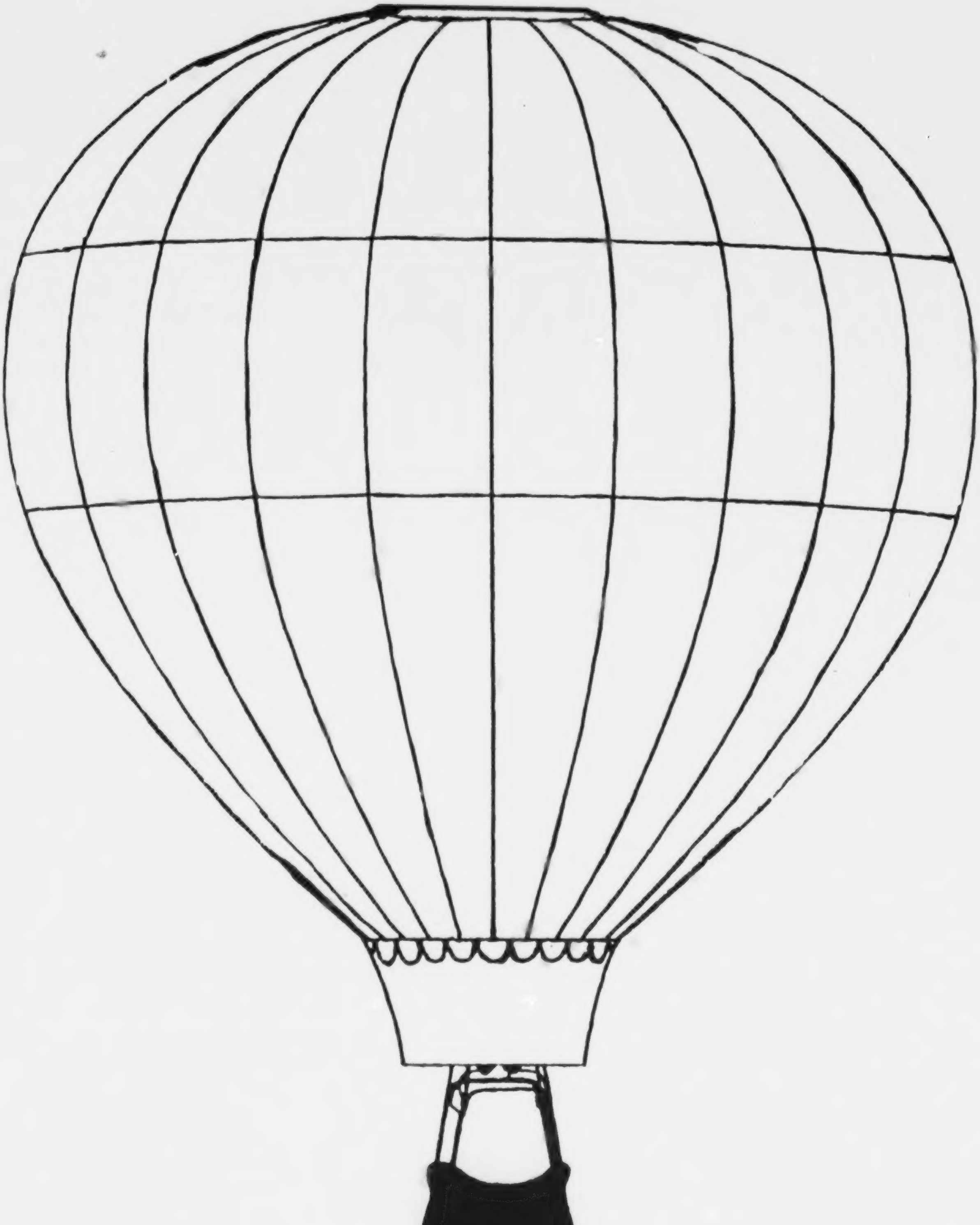
Hello!
My name is
If you find my balloon, please write me at:
(school/center)
(street)
(city,state)

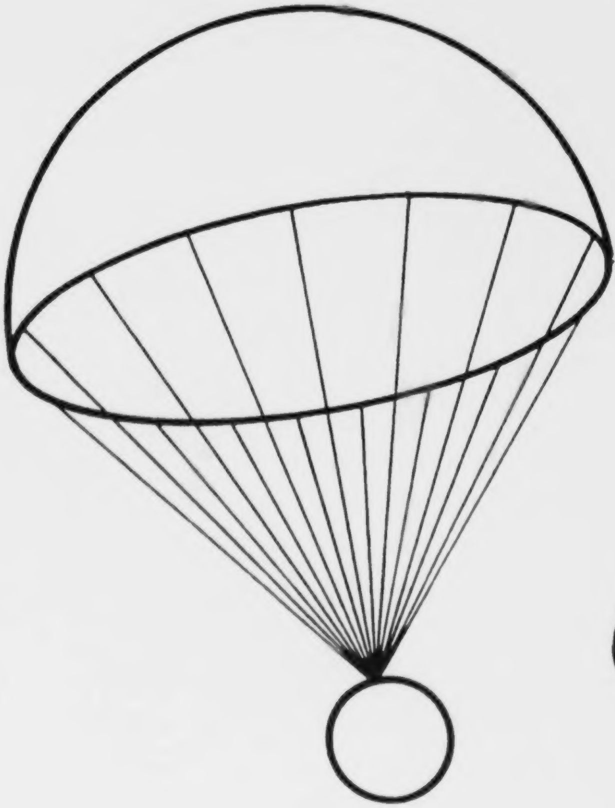
We have been studying the letter 'B' and launched balloons on
Friday, April 13
Thank you for writing to me.

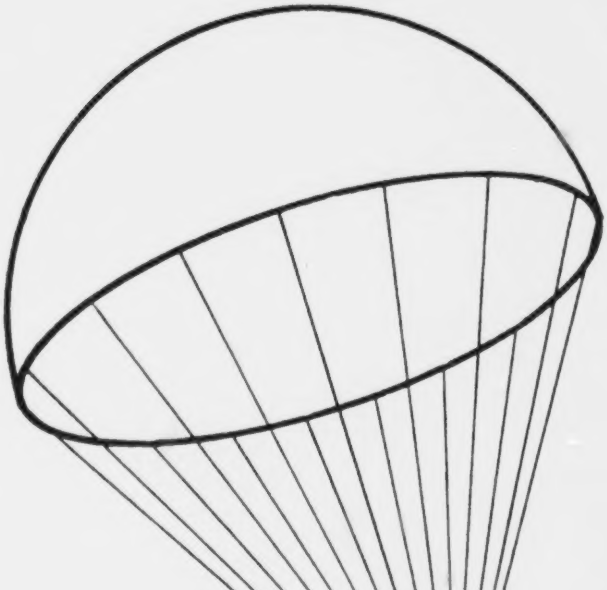
Dear Samantha,
My name is Megan, I live in Burke, Virginia. I go to kindergarten just like you. I found your red balloon in my yard.

Your friend,
Megan









PARACHUTES

NAME: Parachute

SUBJECT/SENSE: Science (Touch)

SKILL: Become aware of drag (air resistance) on a falling object

PROCEDURE:

1. The teacher can make the parachute according to the directions, then have the children toss the parachute into the air, observing it as it falls. Children learn about drag as they watch the parachute fall. (Parachutes are also used on some race cars and some aircraft as they land to increase drag and help them stop.)

   Parachute Directions: Cut 8" piece of thread. Wrap thread around 4 corners of paper towel square. Tie the thread ends together with a weight (paper clip). Materials: Kleenex or paper towel square, thread or string, paper clip (weight)

2. Talk about how parachutes are used in the space program. See background information.

PARENT/CHILD EXPERIENCE:

Find different scraps of cloth at home. With your child make parachutes out of different materials and add different weights. Have your child compare the differences as the parachutes fall. (The cloth will be too heavy unless a heavy weight is used.) Materials: Scraps of cloth, string, weights

OBJECTIVE: Be able to drop the parachute seeing the effects of air on a falling object

BACKGROUND INFORMATION:

The Apollo capsule had to have a parachute after it re-entered the atmosphere to slow it down before it hit the water. The solid rocket boosters on the Space Shuttle Transportation System have to have parachutes to slow them down as they are dropped into the ocean. Parachutes are also used to save your life if an aircraft fails. Packing a chute is very important and you have to have a license to do it. However, there is a reserve chute just in case the main chute fails. The Space Shuttle has a parachute which is used to slow it down when it lands. Many people today parachute as a hobby with colorful sport parachutes. They participate in competitions based on style and accuracy.

AIR HAS WEIGHT

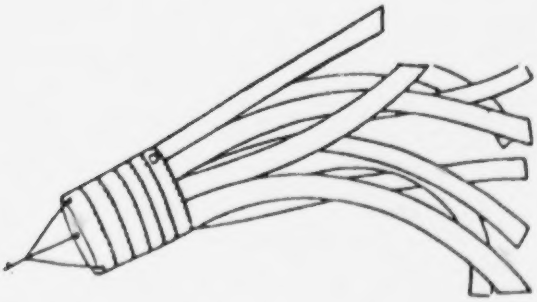
Discuss the concept of atmospheric pressure or air pressure with the children by stating that atmosphere, air, pushes down on the surface of the earth. Demonstrate this concept in the following way.

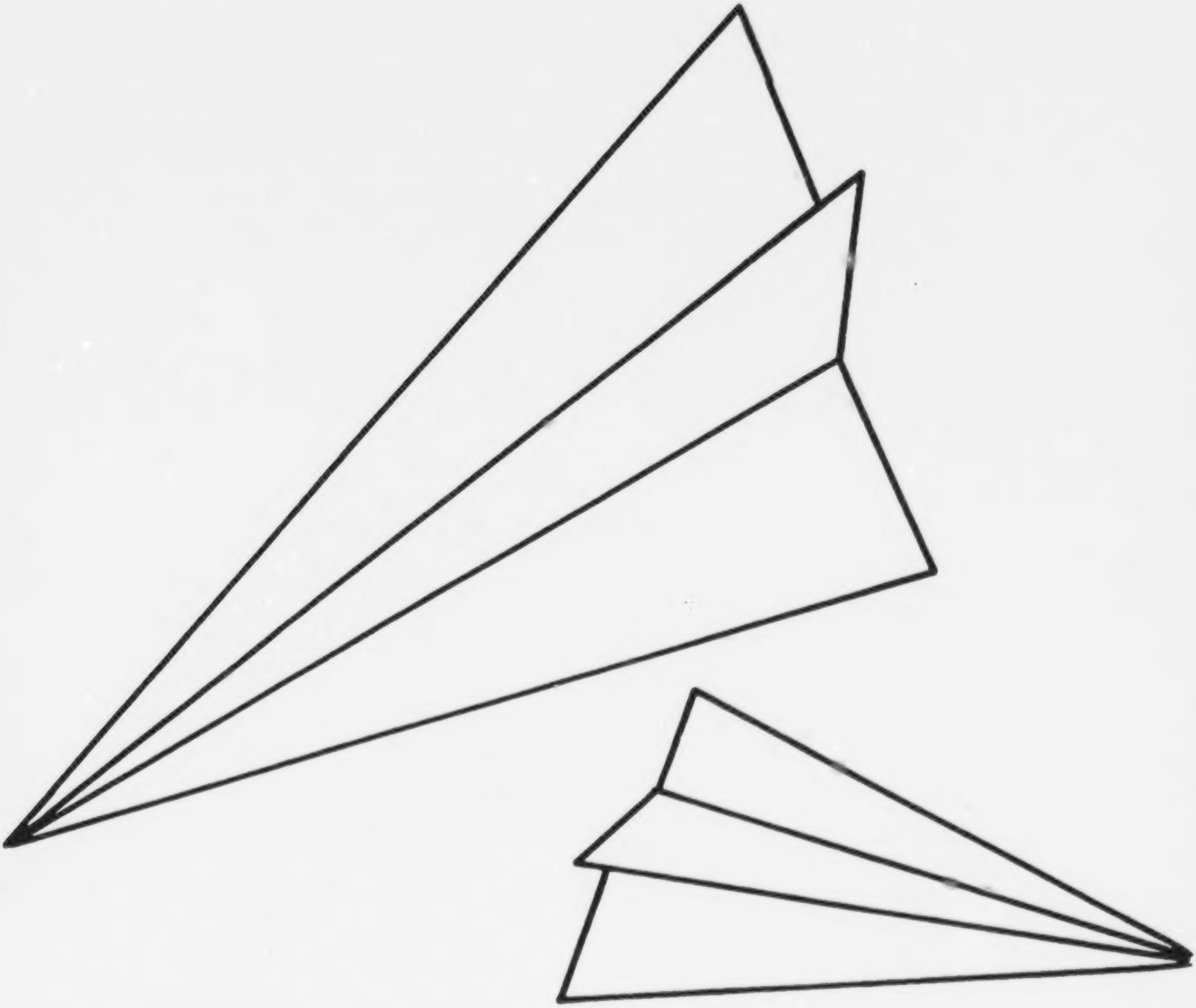
Obtain two identical balloons. Inflate and tie a knot in the end of one balloon. Place the inflated balloon on one end of a yardstick and the empty one on the other end. Ask the children to predict which balloon is heavier and why. Pop the balloon so the children can see if their predictions were correct.

AIR HAS MOVEMENT

Discuss the concept of moving air, wind, with the children. Demonstrate this concept in the following way.

Cut out the center of a plastic coke bottle or an empty oatmeal box. Glue strips of colored tissue paper to the botton inside edge. Attach yarn or string to the other end so the wind sock can be hung in the wind. Children will enjoy observing the effects of air blowing.





FLIGHT

NAME: Flight

SUBJECT/SENSE: *Science (Touch, sight)*

SKILL: Become aware of how aircraft fly, the effects of air on a moving object, the effect of air over an object (lift)

PROCEDURE:

1. The teacher can make the paper helicopter. Then the children can drop the helicopter to see how it flies. The helicopter spins as it floats downward.
   Materials: folder pattern, scissors, paper clips

2. The teacher can make the folded paper airplane and the children can fly it with the teachers directions. Have the children compare it to the paper helicopter flight
   Materials: sheet of plain standard size paper (8l/2 x 11)

3. The teacher will cut out a piece of paper and the children will blow over the top of it to see how it rises. This will illustrate lift to the children (see Background Notes).
   Materials: paper and scissors

4. With the children, visit a local airport to see a helicopter and compare it to an airplane.

5. Trace the airplane body, wing and tail onto a file folder. Pull the wing through the slot on the airplane and the tail into the rudder slot. Place a paper clip on the nose. Have the children fly the plane and see what maneuvers they can make.
   Materials: folder game pattern, scissors, cardboard

PARENT/CHILD EXPERIENCE:

Help your child draw an airplane, noting the front (that thrust makes it move forward) and top (that lift makes it go upward). Talk about how an airplane flies. (An airplane flies because air lifts it up, gravity pulls it down and the propeller and engine pull it forward.)
Materials: paper, crayons

OBJECTIVE: Draw an airplane

BACKGROUND INFORMATION:

The important principle to understand as to why an airfoil can produce lift is to consider Bernoulli's law. He proved that where the speed of a moving gas is high, the pressure is low. Where the speed is low, the pressure is high.

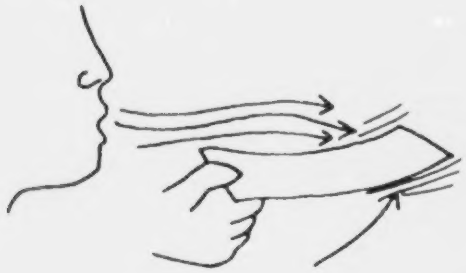
Helicopters were used to find and pickup Gemini, Mercury, and Apollo capsules after they re-entered the earth's atmosphere and parachuted into the oceans. Helicopters are used to track the Shuttle and find the solid rocket boosters as they drop into the ocean.

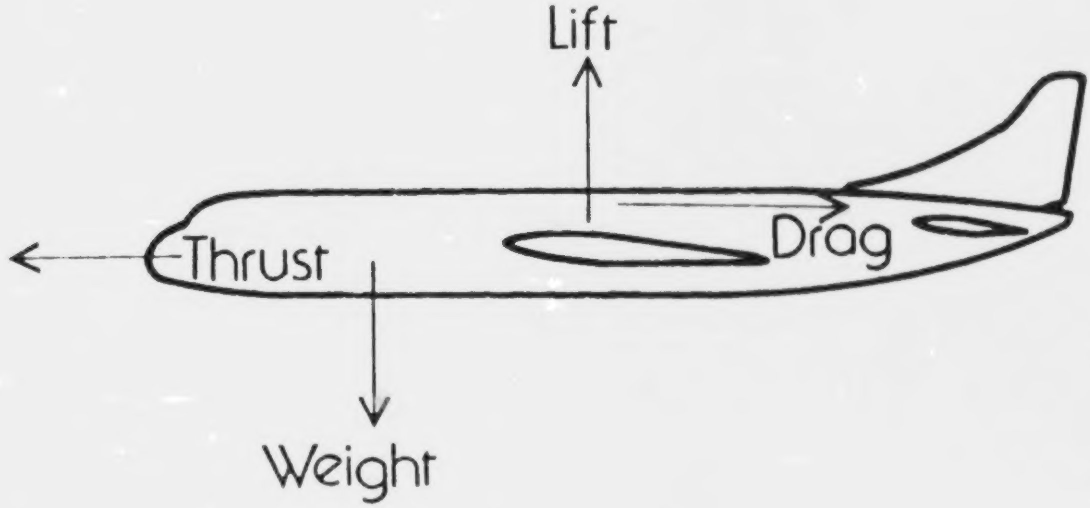
THEORY OF FLIGHT

A simple experiment will help you see how Bernoulli's law works to produce lift.

Cut a piece of paper two inches wide and seven inches long. Hold it against the chin under your bottom lip with the narrow part. Then blow hard over the top of the paper. The paper rises!

What actually happens is the "air in a hurry" on top of the paper has less pressure. The pressure under the paper is greater and lifts the paper up.



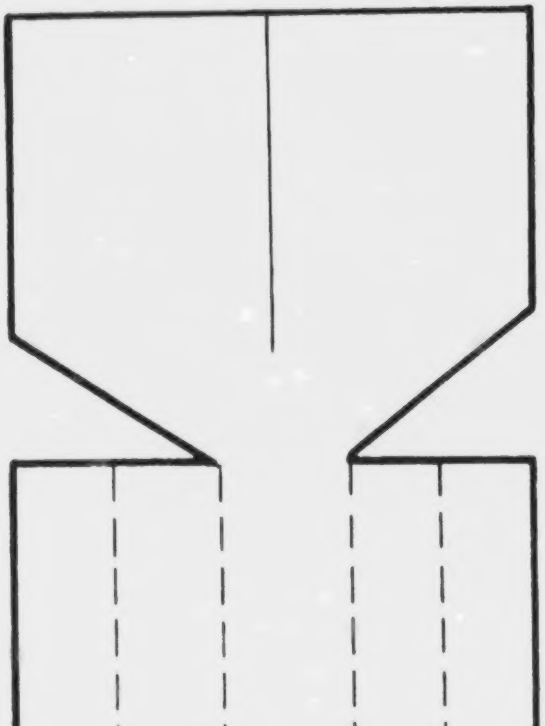


HELICOPTER

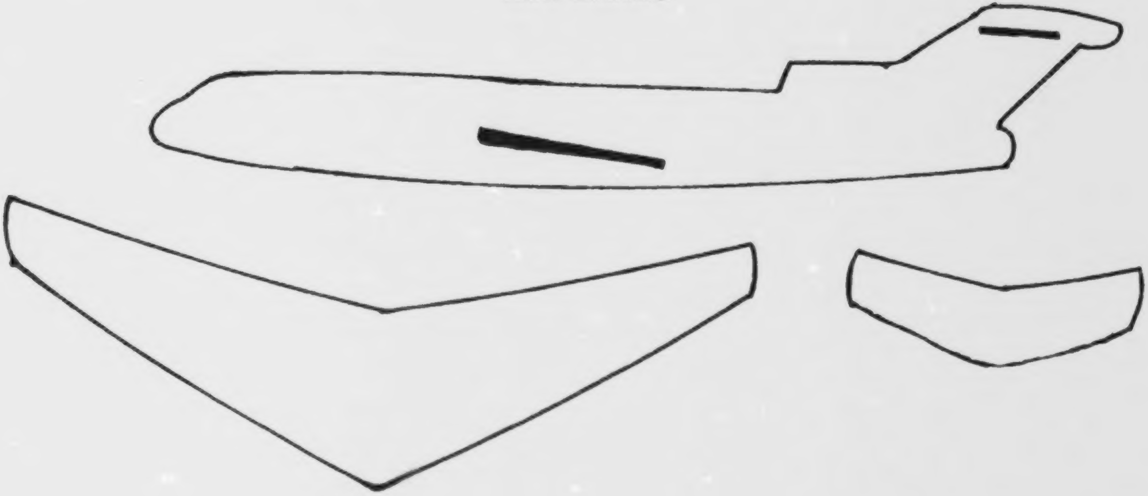
Have you ever watched the aerobatics of fall leaves floating in the wind ? Why do some leaves spin, some float and some glide? Gather an assortment of fall leaves and compare their size, color, Compare other natural objects that blow in the wind, i.e. seeds. Compare the leaves or seeds dropping in the air to the paper helicopers.

Cut on solid lines.
Bend on dotted lines and secure with a paper clip.
Fold flaps at the top in opposite directions.
Drop the helicopter and watch it twirl.
The child can watch the effects of air on a falling object.
The helicopter will spin and spin.

Variation: Make 6 cuts down the sides of a paper cup stopping one inch from the bottom.
Fold the strip outwards.
Flip the helicopter as you would a frisbee.

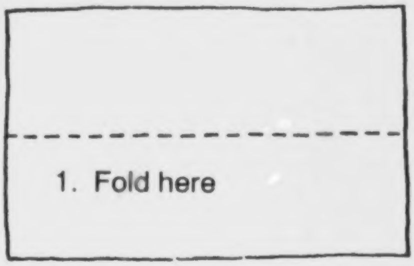


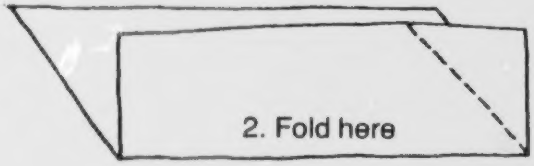
AIRPLANES

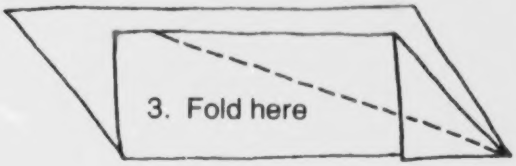


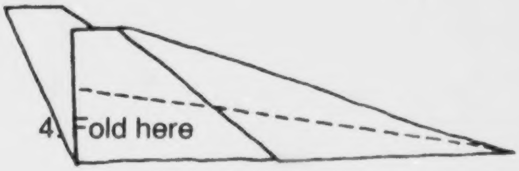
Variation: Allow the child to cut out his own airplane body and wing designs out of styrofoam meat trays. (The teacher will need to cut the insert in the body for the wing using a razor blade or mat knife.) Use a paper clip on the nose to help stabilize the plane.

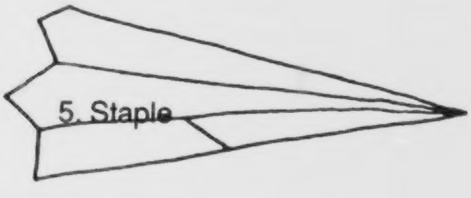
Paper Airplane





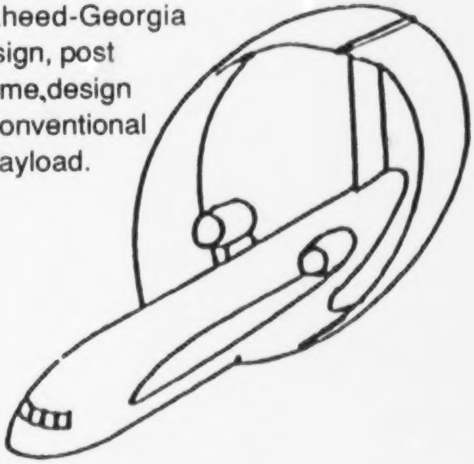






RING WING AIRCRAFT

Lockheed-Georgia
Ring Wing design, post
year 2000 time frame, design
goal - weight half conventional
aircraft, better payload.



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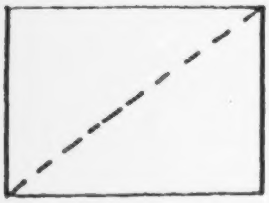

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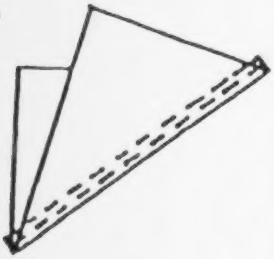

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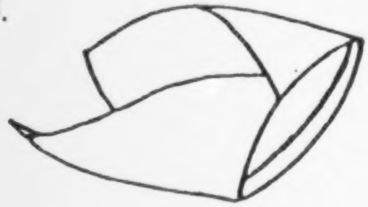

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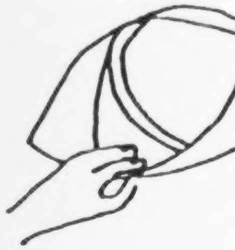


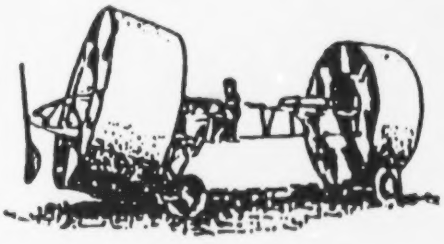
Construction:

1. Fold typing or similar size/weight paper diagonally.

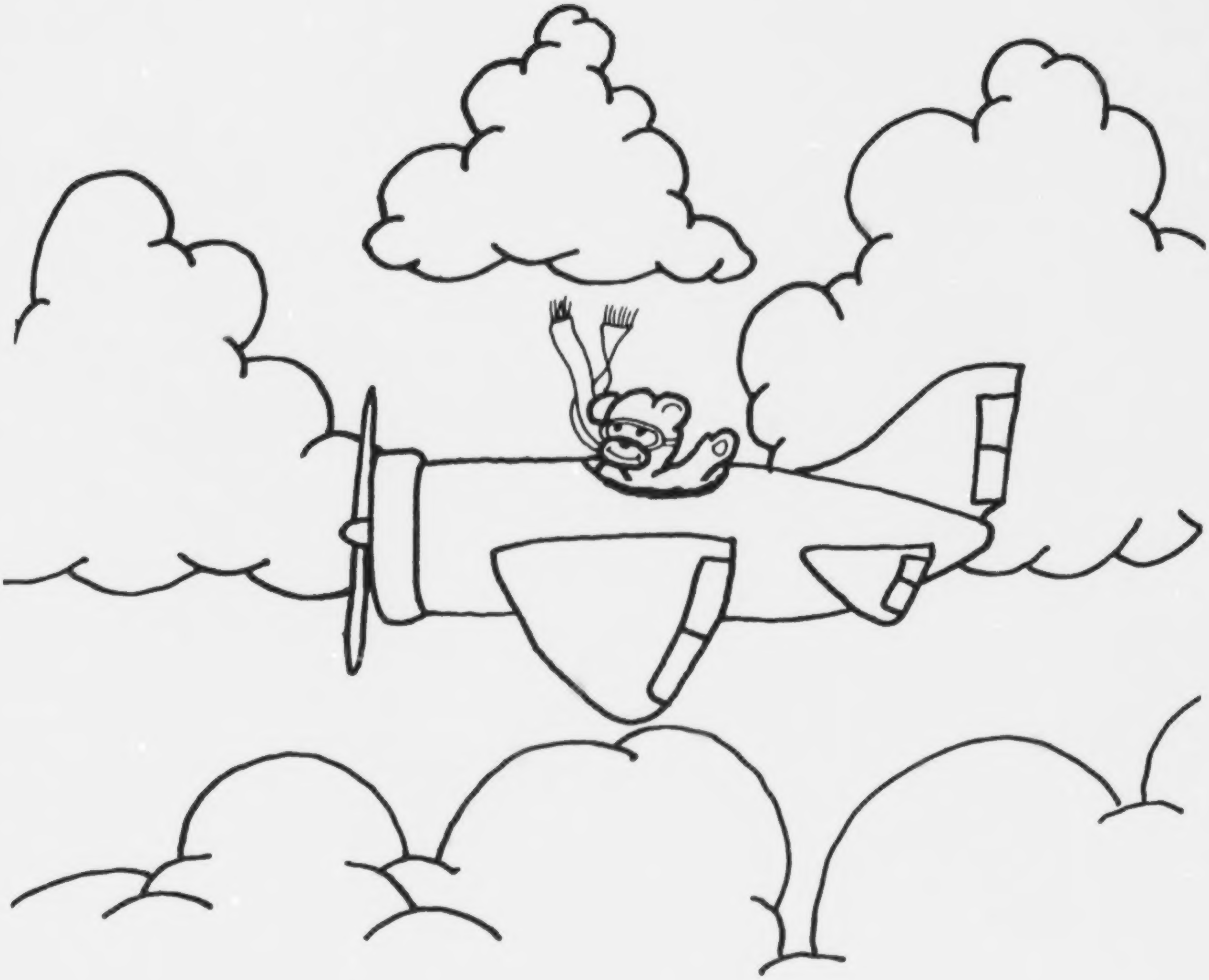
2. Make two or more folds on front, each about one-half inch wide.

3. With the fold on the side, form the paper into a circle. Slip one pointy end into the other.

To fly the Ring Wing, hold with two fingers on top of the "vee", the thumb on bottom, and toss with a smo-o-o-th follow through. Too much speed or the lack of a follow through are no-no's.



early French Ring Wing design



PILOTS

NAME: Pilots

SUBJECT/SENSE: Science (Touch, Hearing, Sight)

SKILL: Develop the ability to follow directions; enhance visual discrimination, become aware of being a pilot

PROCEDURE:

1. The teacher will explain to the children how a trip is planned on the ground using a road map. Pilots plan a trip in the air using an air-way map that shows roads and markers as seen from the air. The pilot files his flight plan so air traffic controllers can tell other pilots where he is flying to avoid an accident. Then if an accident occurs people will know where to look for him. (FAA investigates crashes and CAP performs most search and rescue missions.) Invite a pilot to your classroom to talk about a flight plan.
   Materials: Abbreviated flight plan (See next page)

2. A pilot must fly in a traffic pattern whether flying in a small airplane or a Space Shuttle. The astronaut/pilot will have to adjust his traffic pattern according to how he enters the atmosphere. The teacher will study the traffic patterns and tape them on the floor with masking tape. The children can use a model Shuttle or airplane to follow the traffic patterns, learning directionality.
   Materials: masking tape, flight patterns, model Shuttle or plane

3. The Shuttle's flight controls are like an airplane. The teacher should show the picture of an airplane to the children and ask them to find the parts that are also on the Shuttle. The children can point to or color the laminated folder game one part at a time as the parts are located. While they are doing it, visualization is enhanced.
   Materials: Airplane pattern

4. To further increase visualization the matching aircraft folder game can be made by the teacher for the children to play
   Materials: matching aircraft folder game

5. A magnetic compass is a very important instrument in an airplane. It points to the North so the pilot will know which direction he is going. There is not enough gravitational pull in orbit for the Shuttle pilot to use a magnetic compass. He must use other ways to locate his position. Assemble a variety of small objects and let the children test them with the magnet. Have them sort them as magnetic or not magnetic. Classification skills are enhanced.
   Materials: Magnet, various small objects

6. The airplane maze and dot-to-dot airplane folder games can also be played by the children to enhance numeration to ten.

PARENT/CHILD EXPERIENCE:

1. Try to visit a local airport with your child. If a pilot is available he may show you the parts of an airplane. Your child can compare the different airplanes at the airport.

2. After the airplane lands it may go to an airport garage called a hangar. The child can make airplane hangars out of boxes and count small model airplanes as they enter into their hangars. If boxes and model airplanes are not available the folder game pattern can be used to create this game. Numeration to ten will be enhanced.
   Materials: boxes, model airplanes or folder game patterns, scissors, markers

OBJECTIVE: Visit an airport; place airplanes in hangars

BACKGROUND INFORMATION:

After the Wright Brothers flight in 1903 until World War I in 1914 only about 1,000 aircraft existed in the whole world. During the next four years thousands of aircraft were produced to be used in combat. Mail and passenger service began in 1925. During World War II more aircraft were produced before jets emerged. Today in the United States about one million people fly small airplanes yearly. Many pilots and other aerospace jobs are necessary. The pilots that fly the Space Shuttle are airplane pilots with 1,000 hours flying jets before they apply for astronaut training. They are military pilots paid by the military according to their service rank whether they fly a small airplane or the shuttle. Some of these pilots are Lt. Colonel Terence (Tom) Henricks, Colonel Frederick Gregory, and Major Eileen Collins. Pictures and information about pilot astronauts can be obtained free by writing NASA. (See Resources). Information about the military pilots organization, Daedalians,can be obtained from Kelly Air Force Base, Bldg. 1660, San Antonio, Texas 78241. Awards, trophies and youth scholarships are presented to those who work toward the Daedalian goals, i.e. insuring America's preeminence in Air and Space. Upon request, local Daedalians may visit your class to tell you about becoming a pilot.

HOW DOES THE PILOT KNOW WHERE TO GO?

A pilot has a map that shows airports and mountains and rivers and railroad tracks and other landmarks that you can see from the air. He has a radio to talk to people who tell him where to fly and how high to fly. He also has a compass to tell him what direction to go. A compass points to north, south, east and west. You can make a compass with a dish of water, a cork, a needle and a magnet. Rub a needle in one direction against the magnet. Put the needle through a cork. Lay the cork in a pan of water. The needle will point to the magnetic north.

An astronaut pilot uses the system of star tracking--he locates a star and follows it. Teacher note: This is a shortened version of some of the items necessary for filing a flight plan.

FLIGHT PLAN

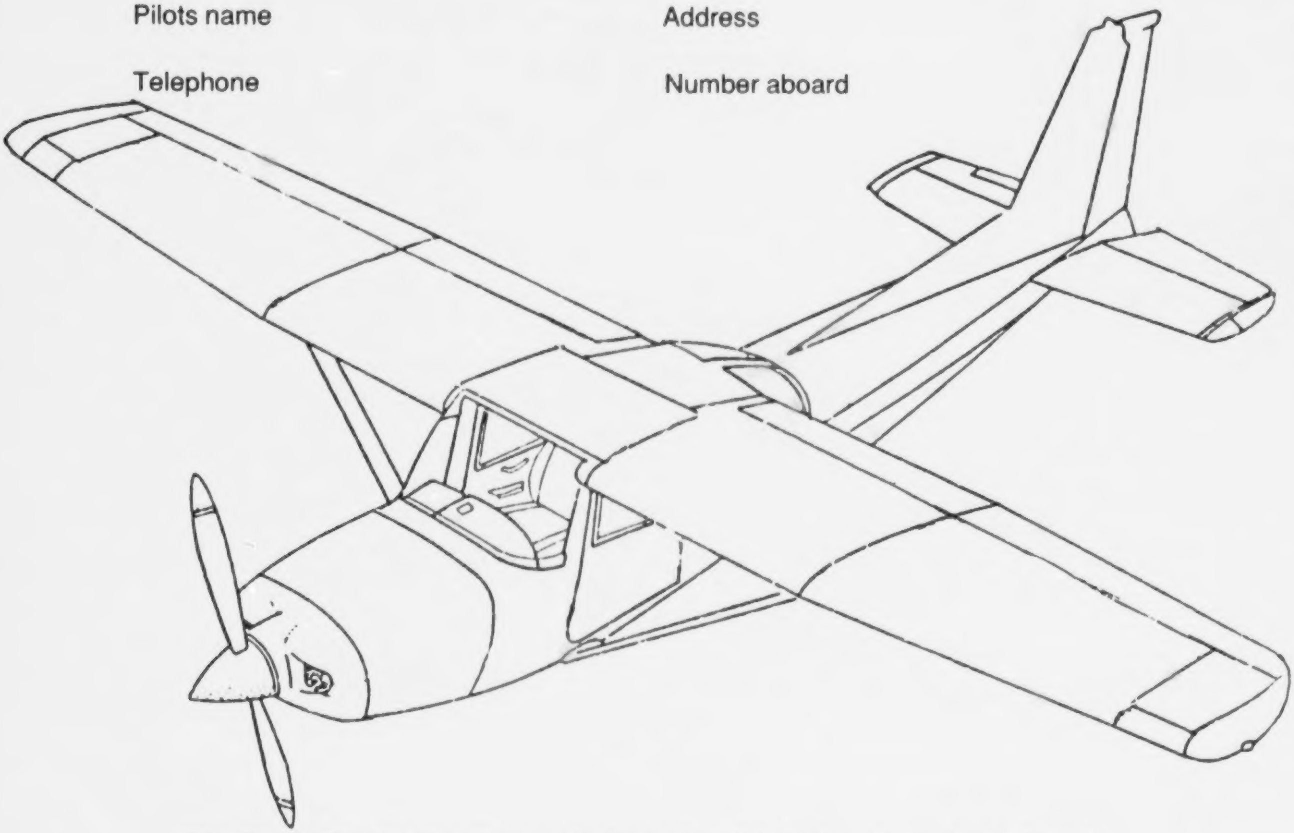
Departure Point
Departure Time

Destination (airport, city)

Estimated time enroute

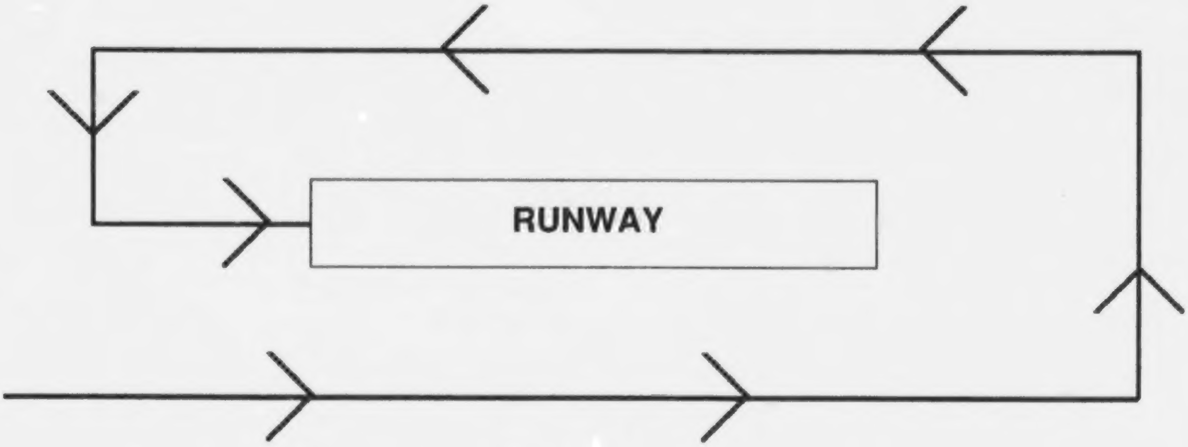
Pilots name
Address

Telephone
Number aboard



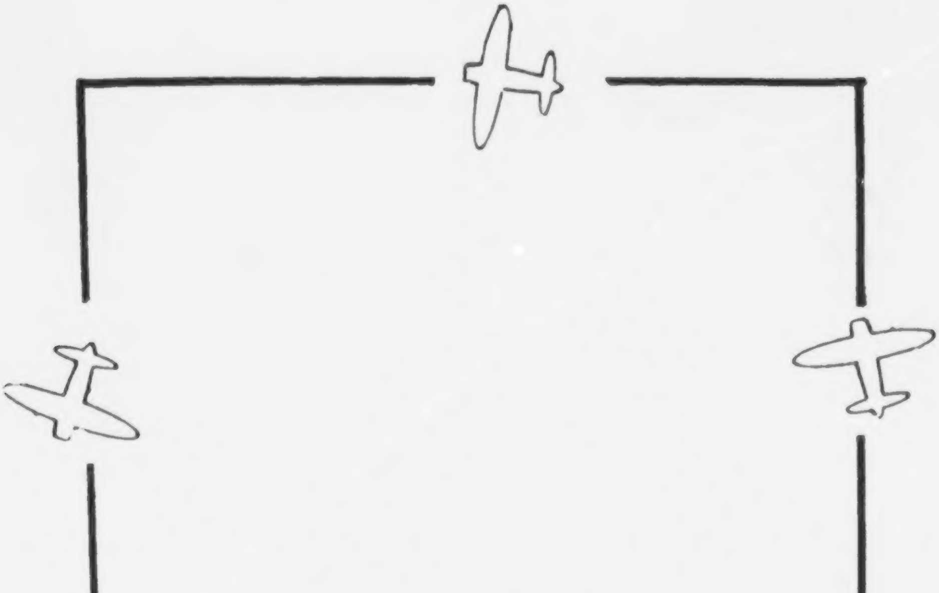
The Space Shuttle flies like an airplane when it is in the atmosphere. Find the main parts of the airplane that are also on the Space Shuttle:

wing
door
tail
body (fuselage)



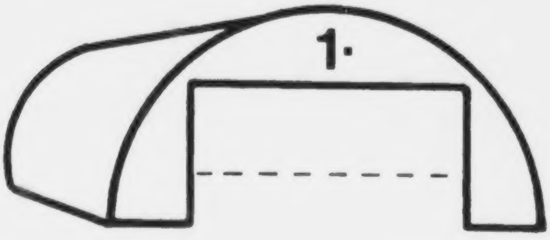
STANDARD TRAFFIC PATTERN

Pretend you are a pilot landing your plane. Listen to the planes as they take-off and land. Sounds (loud-soft, vibration, caused by aircraft noise and the direction from which the plane is coming or going) will be enhanced.



RECTANGULAR COURSE

A pilot-astronaut follows a flight pattern as he lands on the earth. He must vary the flight pattern according to different information he receives from Mission Control and his flight instruments.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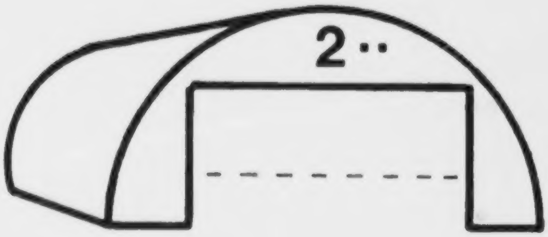
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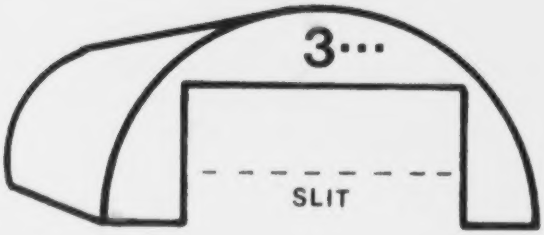
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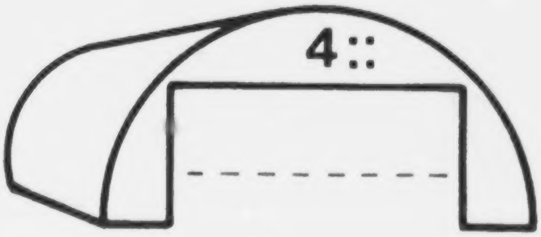
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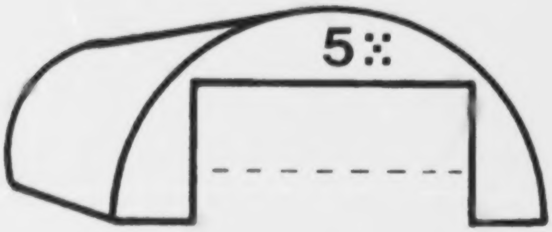
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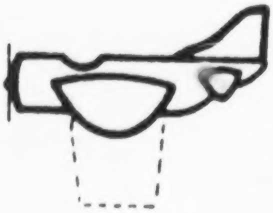

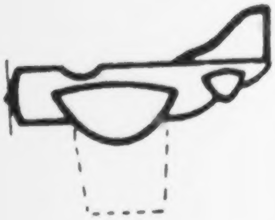

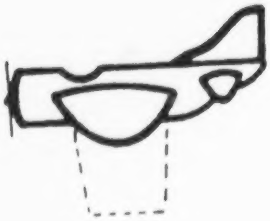

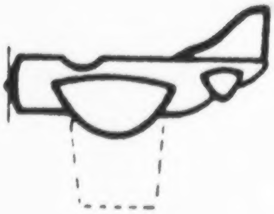

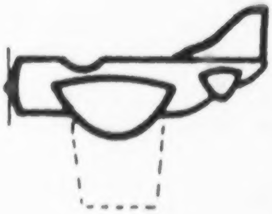

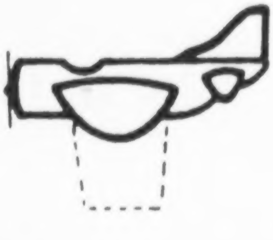

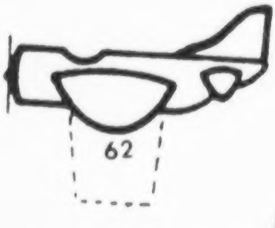
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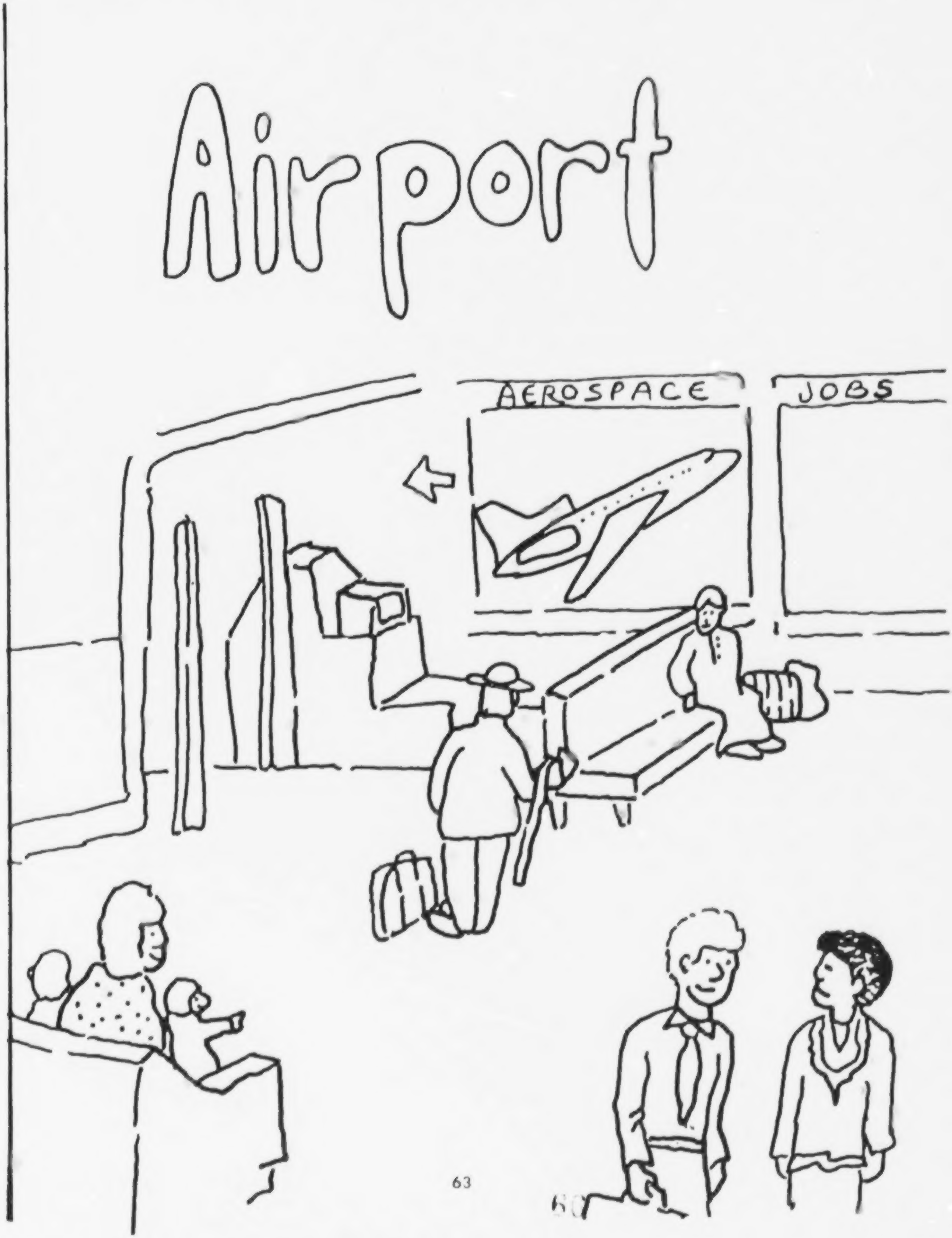

Airport
AEROSPACE
JOBS

NAME: Aerospace Jobs

SUBJECT/SENSE: Science (Hearing, sight)

SKILL: Become aware of different jobs

PROCEDURE:

1. The teacher will discuss some of the people that work at an airport using the free publication.

   A Trip to the Airport, FAA
   800 Independence Ave., S.W.
   Washington, D.C. 20591
   Read the story. (It is in English and Spanish)
   Materials: Publication

2. The teacher can invite an airport worker to class to discuss his job.
   Materials: Guest speaker

3. The teacher can discuss some of the jobs that the children are familiar with that can be performed in aviation-space environments. For example:

   Policeman--security is very important at the airports and around the Space Shuttle to prevent accidents.
   Fireman--airplanes and rockets may catch on fire because of the intense heat and huge amount of fuel, so firemen are very important.
   Artists need to design and draw new airplanes and spacecraft and space stations based on principles of flight.
   Engineers are needed to make the planes and spacecraft.
   Mechanics are needed to fix the planes and spacecraft.
   There are many, many more jobs.
   Materials: Prop boxes with various items to help the children role-play. These jobs can be placed in the drama center

4. Make pilot head sets or use available earphones with a mouthpiece attached. Encourage the children to talk into the earphones dramatizing being a pilot.
   Materials: Headset, mouthpiece

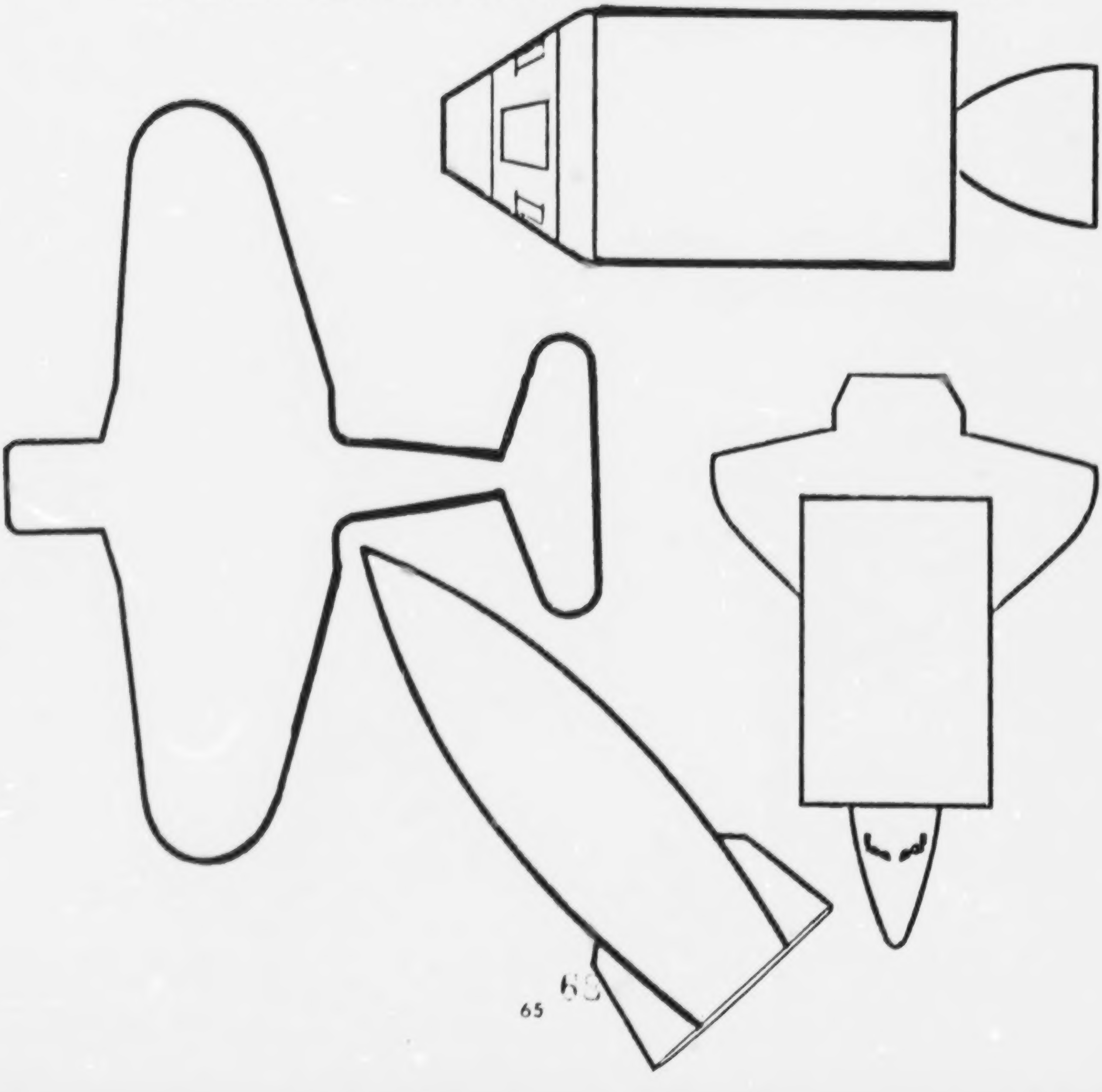
PARENT/CHILD EXPERIENCE:

Encourage your child to tell about an imaginary airplane trip. Encourage him to tell about where he is going, what he would find, and why he wants to go there.

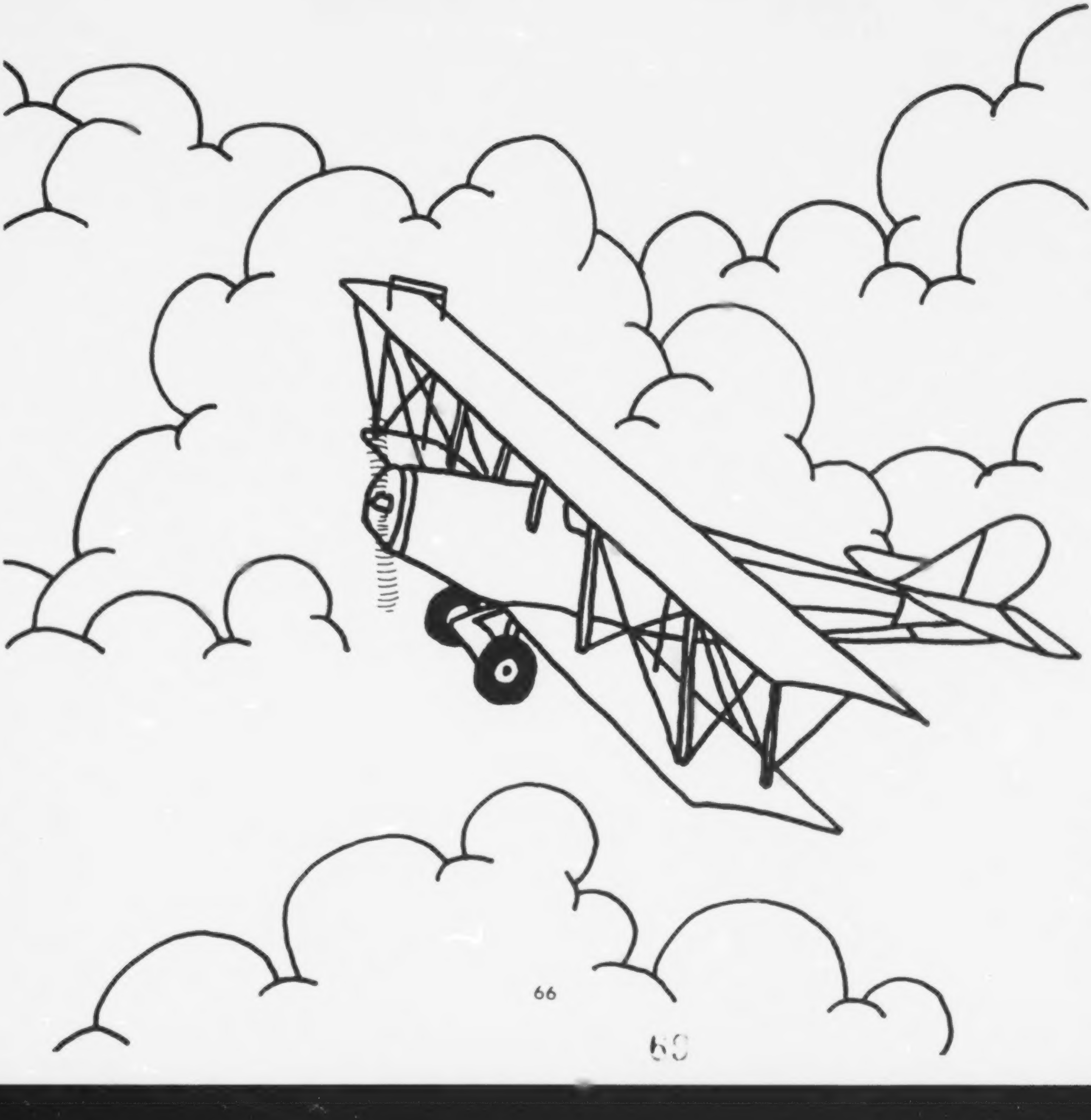
OBJECTIVE: Talk about an airplane trip

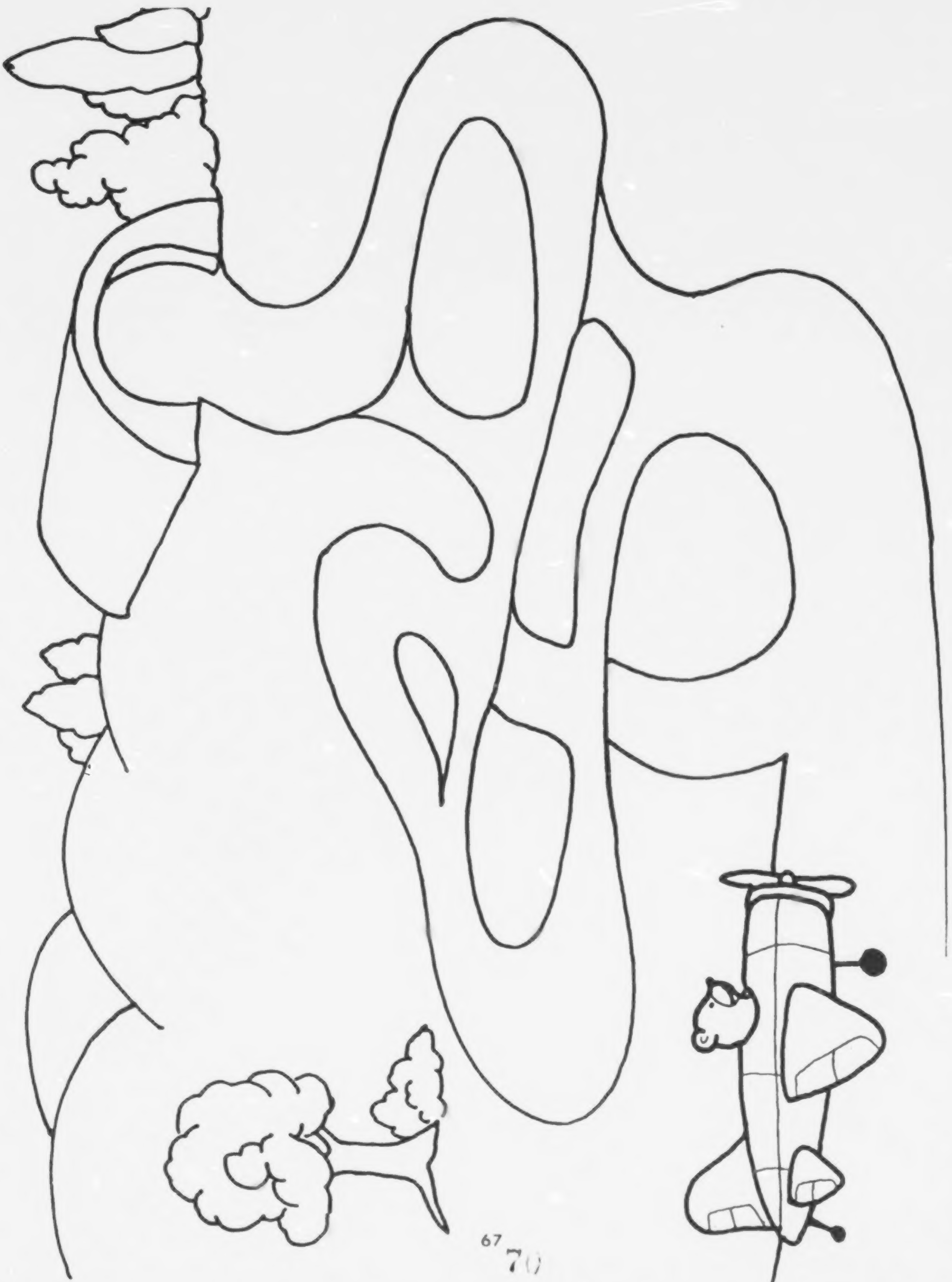
BACKGROUND INFORMATION:

If possible take a field trip to an airport to observe how many different types of jobs you saw, or read the FAA Career Awareness Series to provide more background on aerospace careers. (See Resources) Use the aerospace symbols for name tags.

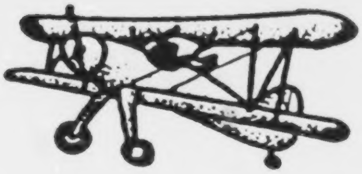


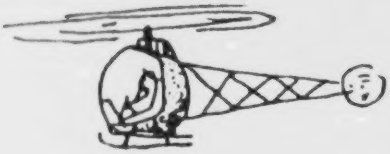
AIRPLANE

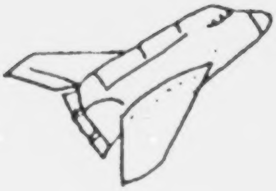


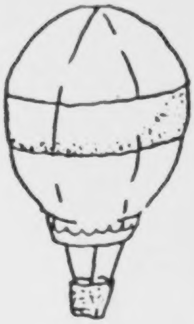


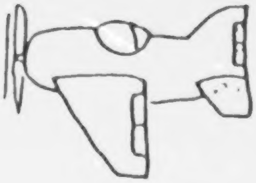
AIRCRAFT MATCHING

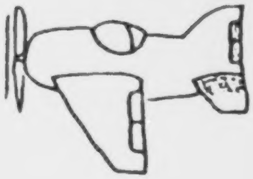


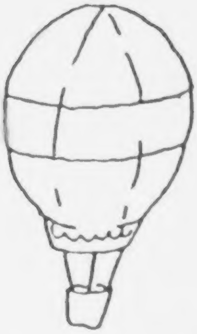


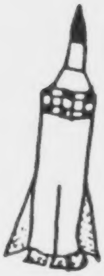


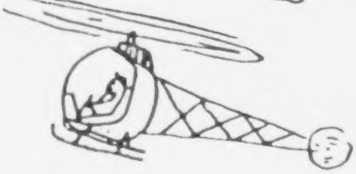


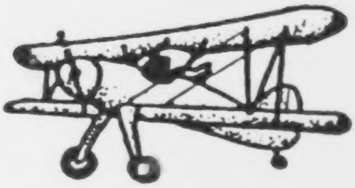


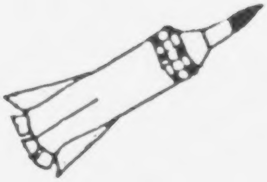


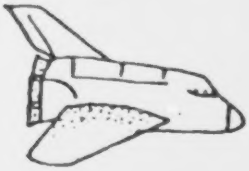




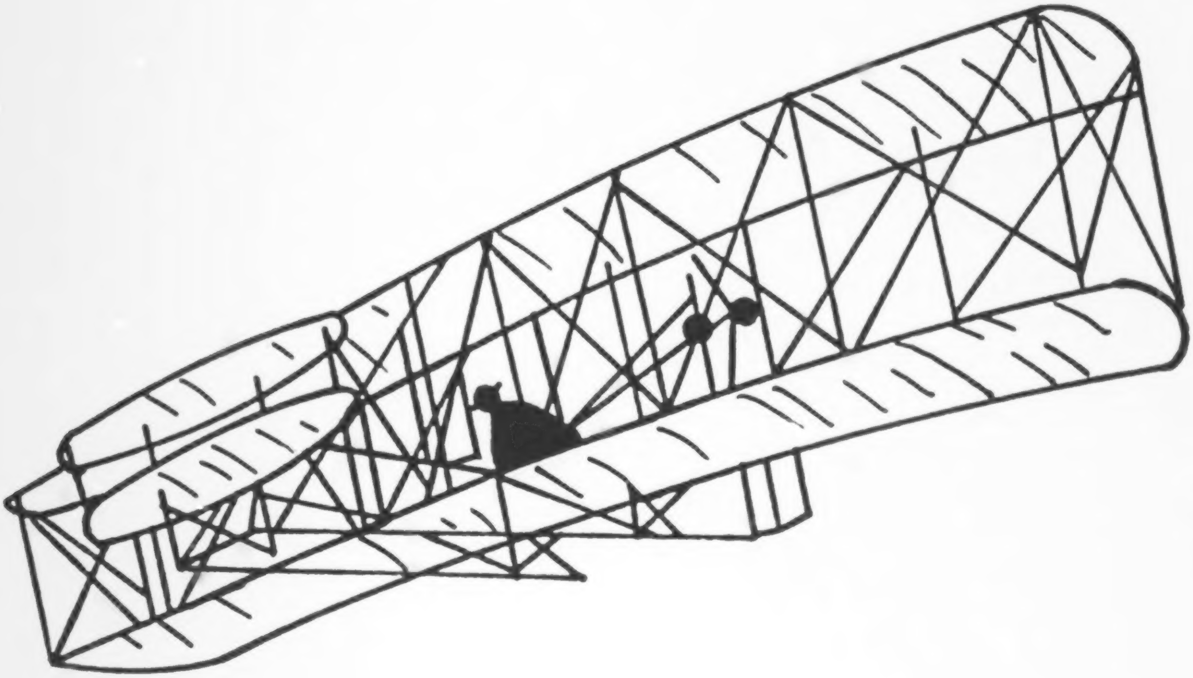








AEROSPACE



PIONEERS

NAME: Aerospace Pioneers

SUBJECT/SENSE: Science (Hearing, sight)

SKILL: Become familiar with role models

PROCEDURE:

1. The teacher will read the story about the Wright brothers to the children and ask questions i.e., Who made the first flight? Where did the Wright brothers make their first flight? Listening and comprehension will be enhanced.
   Materials: folder game stories

2. Show pictures of other aerospace pioneers. Talk about them. Obtain free astronaut pictures from NASA.
   Materials: Astronaut pictures (See Resources)

3. Many people in aerospace can become role models to children as they grow older. Talk about different pioneers in aerospace.

PARENT/CHILD EXPERIENCE:

Talk to your child about aviation when you were his age. How did you travel compared to how people travel today?

OBJECTIVE: Listen and answer questions

BACKGROUND INFORMATION:

Christa McAuliffe, the first teacher selected to go into space was going to present the lesson "Where We've Been, Where We're Going, and Why" We must know something about pioneers in aerospace so we can provide role models for children.

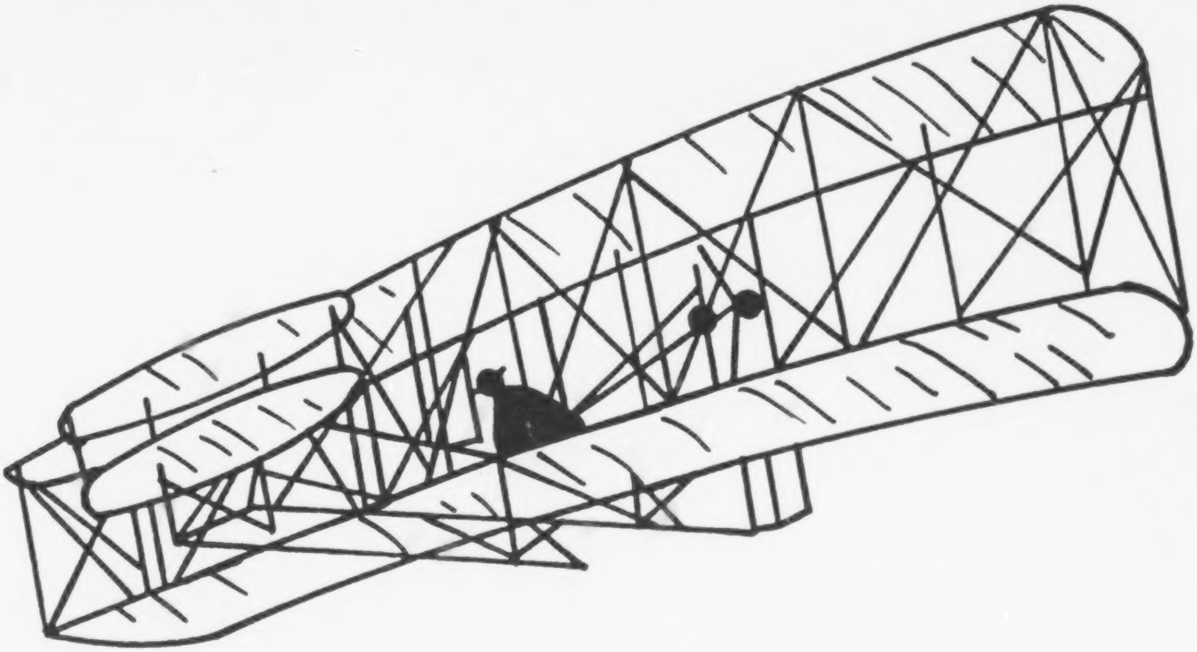
1792--Montgolfier's built the first balloon
December 7,1903--Wright Brothers built first powered sustained and controlled flight of heavier than air vehicle
1914-1934--Charles Lindbergh, Amelia Earhart, Jimmy Doolittle set speed and altitude records
1947--Chuck Yeager broke the sound barrier
1962--John Glenn, First American to orbit the earth
July 20, 1969--Apollo 11's lunar module Eagle, with Neil Armstrong and Buzz Aldrin, landed on the moon.
1981--Space Shuttle Columbia successfully launched with John Young and Robert Crippen
1991--The launch of STS 44 on Nov. 24 completed 44 launches of the Space

Shuttle with Dr. Story Musgrave logging the most hours in space to date, 597 hours, on his fourth Space Shuttle flight.

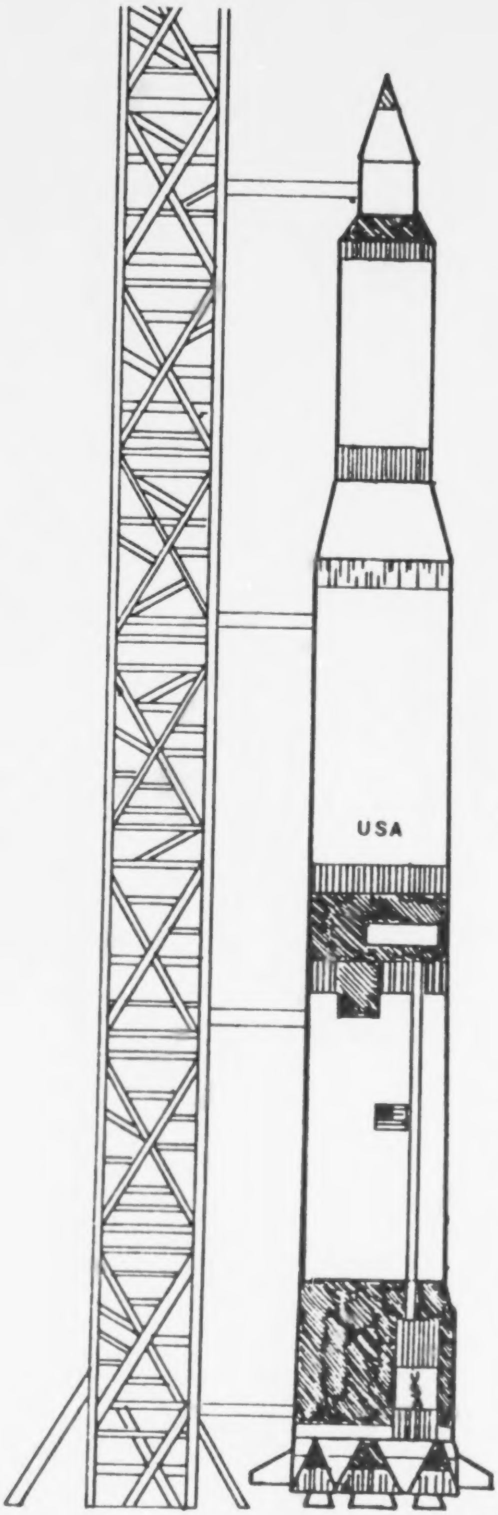
Orville and Wilbur Wright

Orville and Wilbur Wright were two brothers that built bicycles. They experimented in their bicycle shop and built the first airplane with a power motor. Then it came time to try to fly the airplane. As the sun rose on December 17, 1903 in Kitty Hawk, North Carolina, a bitter wind blew. The brothers took off! The airplane worked! They had done somethmg man had always dreamed of doing but never had--fly!

The people in the Wright Brother's neighborhood did not think it was a very important thing that happened, but we know it was. If it weren't for that first flight a million people a day would not fly on airplanes today.



ROCKETS



NAME: Rockets

SUBECT/SENSE: Math (Sight) Science (Sound)

SKILL: Become aware of thrust; reinforce sequential ordering

PROCEDURE:

1. The teacher can cut out the rocket sequence pictures, color and laminate. Place numerals on the back to make the game self-correcting. The children can arrange in sequential order. Younger children will use less pictures and work up to the six frames. (The pictures can be attached at the top and flipped at the bottom to create a flip book.)
   Materials: folder game sequence pictures, scissors, colors

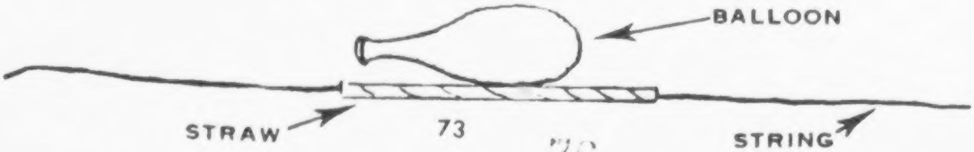
2. The teacher can cut out the rockets and rectangles and laminate for durability. Seriation (putting objects in order) can be introduced. The children can place the rockets in a series from short to tall and tall to short. This concept will be extended with the ten rectangles.
   Materials: folder games seriation patterns, scissors

3. The teacher will cut a 6-foot length of string. Thread it through a straw. Tie each end of the string to the back of a chair or some other object which will keep the string stretched tight. Next, blow up a balloon and, while keeping it tightly closed to prevent the air from escaping, tape the balloon to the straw (see diagram). Release the balloon. Measure how far it went. Repeat this three times, using different amounts of air each time. Ask the children what they observed about the distances traveled.
   Materials: string, straw, balloon

PARENT/CHILD EXPERIENCE:
The parent will blow up a balloon to demonstrate that a rocket needs thrust to blast-off. As your child lets a balloon go the air is released from it causing it to move forward. Materials: balloon

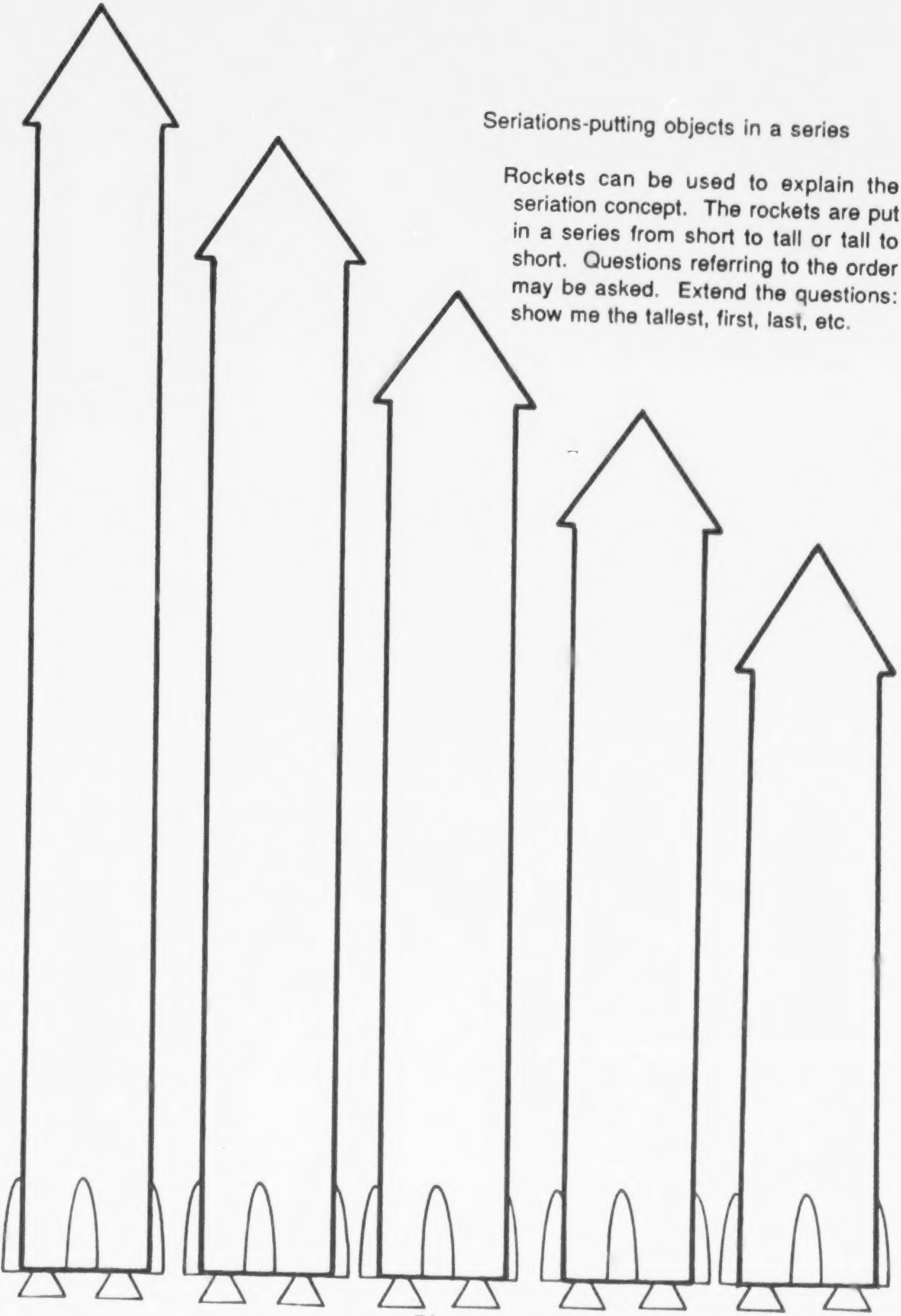
OBECTIVE: Listen to the rocket balloon

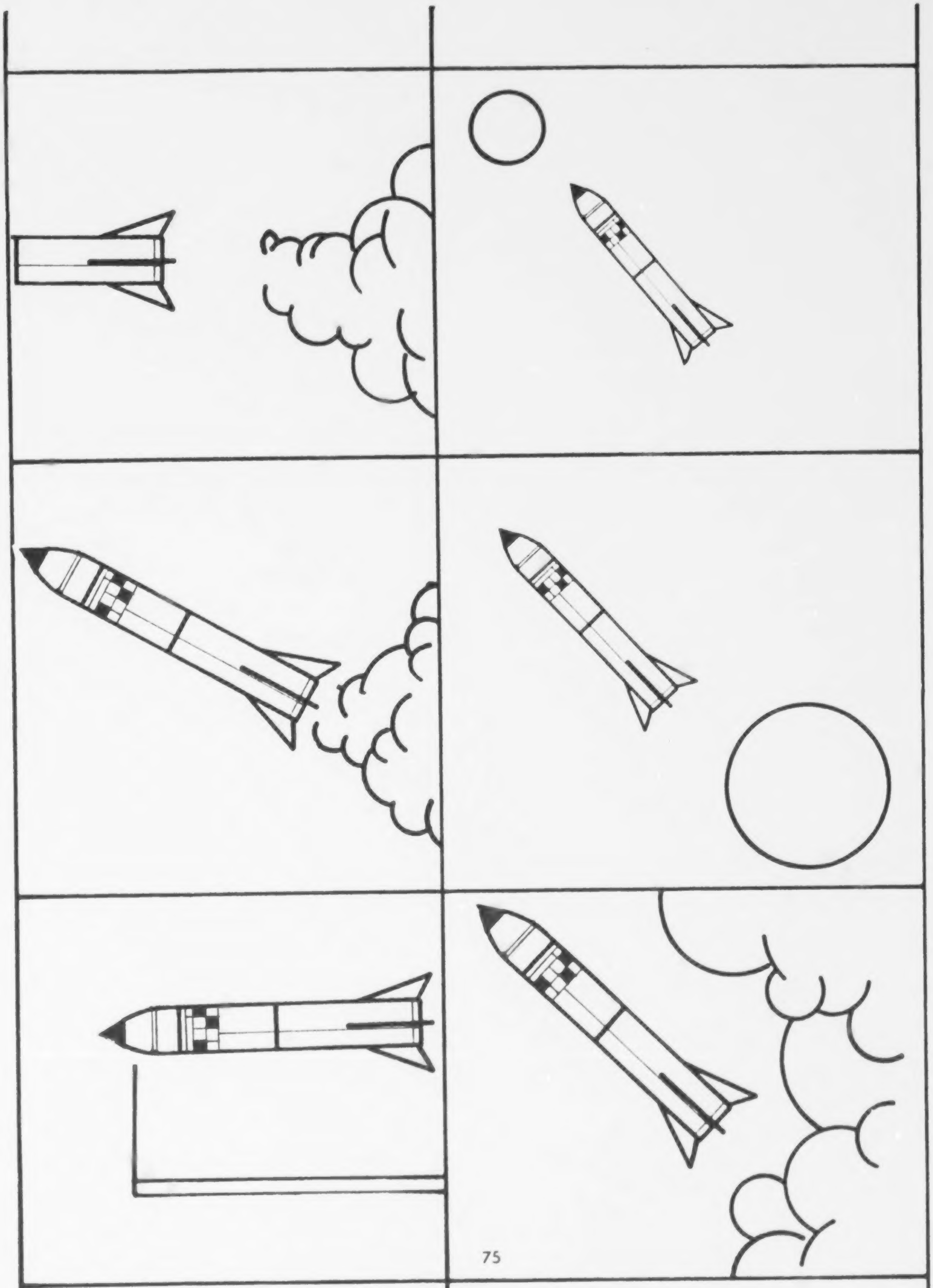
BACKGROUND INFORMATION: A rocket is based on Newton's Law that for every action there is an opposite reaction.

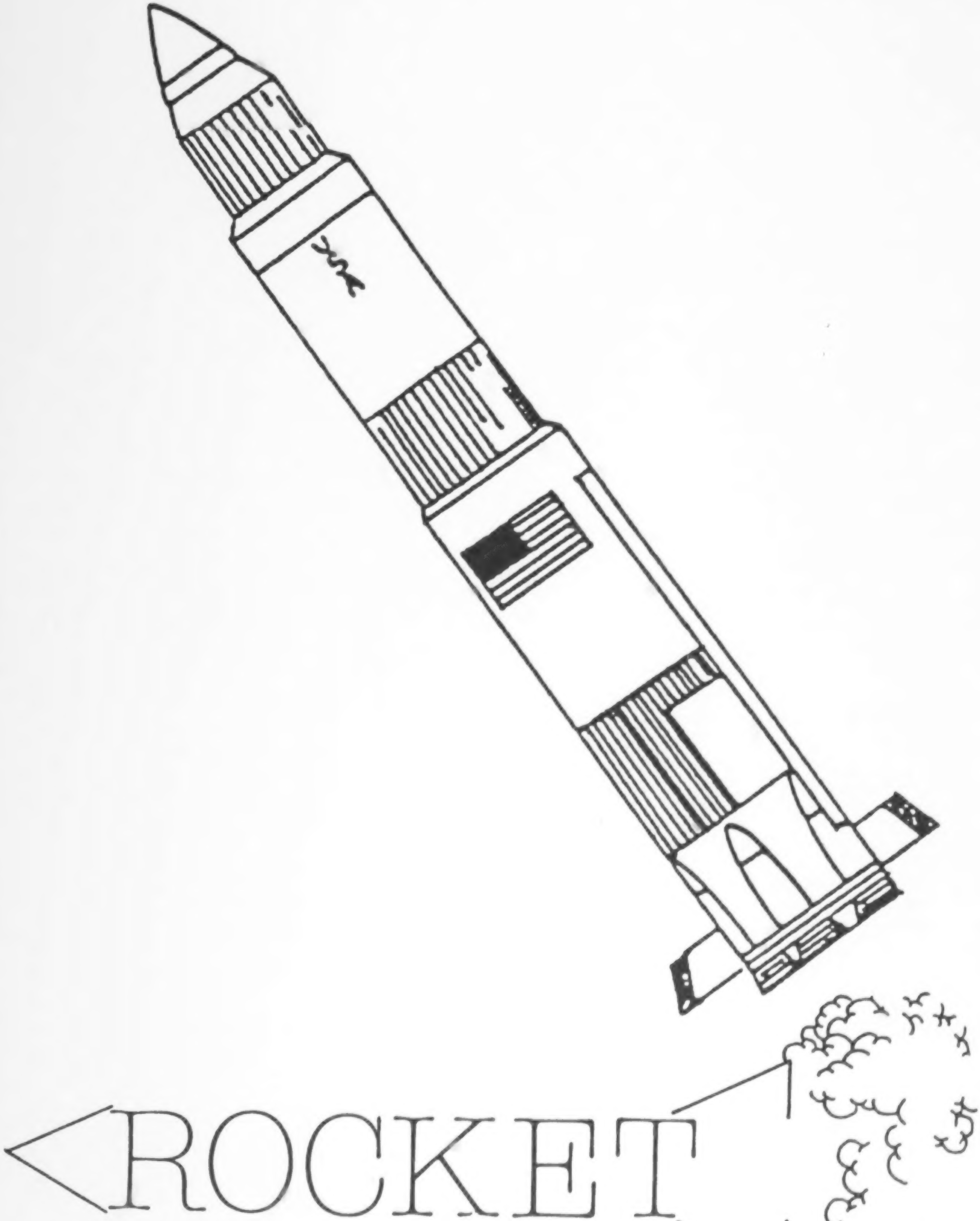


Seriations-putting objects in a series

Rockets can be used to explain the seriation concept. The rockets are put in a series from short to tall or tall to short. Questions referring to the order may be asked. Extend the questions: show me the tallest, first, last, etc.







76

NAME: Rocket

SUBJECT/SENSE: Science (Hearing), Math (Hearing)

SKILL: Enhance shape recognition, develop fine motor development, and enhance auditory discrimination

PROCEDURE:

1. The teacher will read the rocket poems. The children will follow along acting out a rocket blast-off.
   Materials: poems

2. The teacher will laminate the rocket tangram (shapes reassembled into different figures). Laminate a second set of rocket shapes or trace onto cardboard. The children can match the squares and triangles to the rocket shape. The shapes can be color-coded for younger children to match shape and color.
   Materials: folder, pattern, glue, scissors, markers

3. Show different pictures of rockets to the children. Encourage them to build rockets and launch pads with their blocks and dramatize a rocket launching.
   Materials: blocks, rocket pictures available from NASA (See resources)

PARENT/CHILD EXPERIENCE:

Help your child make a rocket out of a cardboard cylinder (see next page for directions).
Materials: cardboard cylinder, paper, scissors, glue or tape

OBJECTIVE: Create a rocket

BACKGROUND INFORMATION:

After the launching of Sputnik, NASA was established to manage our new space program. Liquid fueled rockets launched satellites into orbit around earth. The Mercury Program (1961-1963) with six missions and the Gemini Program (1965-1966) with ten missions preceded the Apollo Program (1968-1972) with 11 missions. During the Apollo Program a giant rocket called Saturn V took men to the moon. The Shuttle program uses solid-fueled rockets to assist the liquid-fueled rockets to take the Shuttle into orbit. The solid-fueled rockets fall into the ocean and are recovered. The liquid-fueled rockets bring the Shuttle back to earth.

ROCKETS

Procedure: The simplest rocket that you can make is with a toy balloon. When the balloon is inflated the pressures acting against the wall of the balloon are in balance. When the outlet is opened, gas discharges through the opening and the balloon moves in the opposite direction. This is the same principle of the actual rocket engine. Why does the balloon (rocket) move forward? Because of Newton's law: For every action there is an equal and opposite reaction.

Materials: Empty cardboard cylinders, rolled up paper, paper cup, tape, paint, any other materials the children can think of. Let them be creative!

Procedure: Have the children study pictures of rockets and then design their own. They may like to decide where they will blast off to and what they will discover.

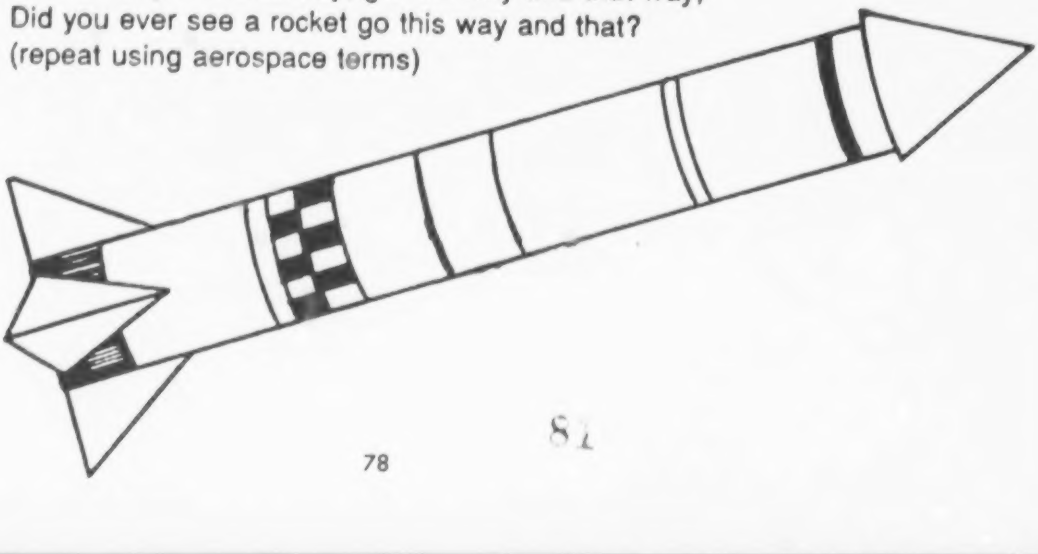
Procedure Have the children learn the poems below.

I 'M A LITTLE ROCKET (SHUTTLE)

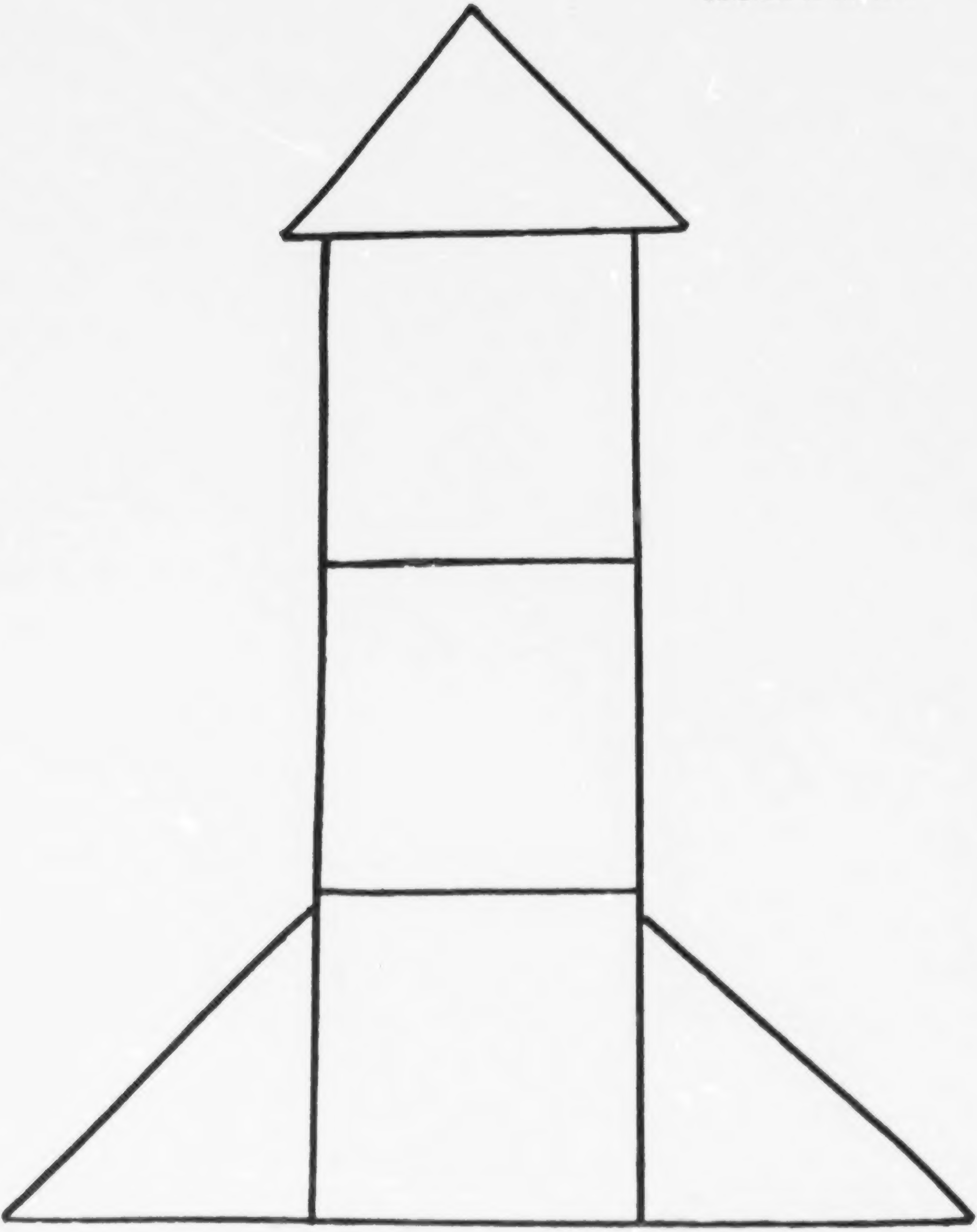
I'm a little rocket (child squats)
Pointing to the moon (points arms upward)
4...3...2...1... (repeat slowly)
Blast off! Zoom! (spring into the air)

DID YOU EVER SEE A ROCKET (tune-Did you ever see a Lassie)

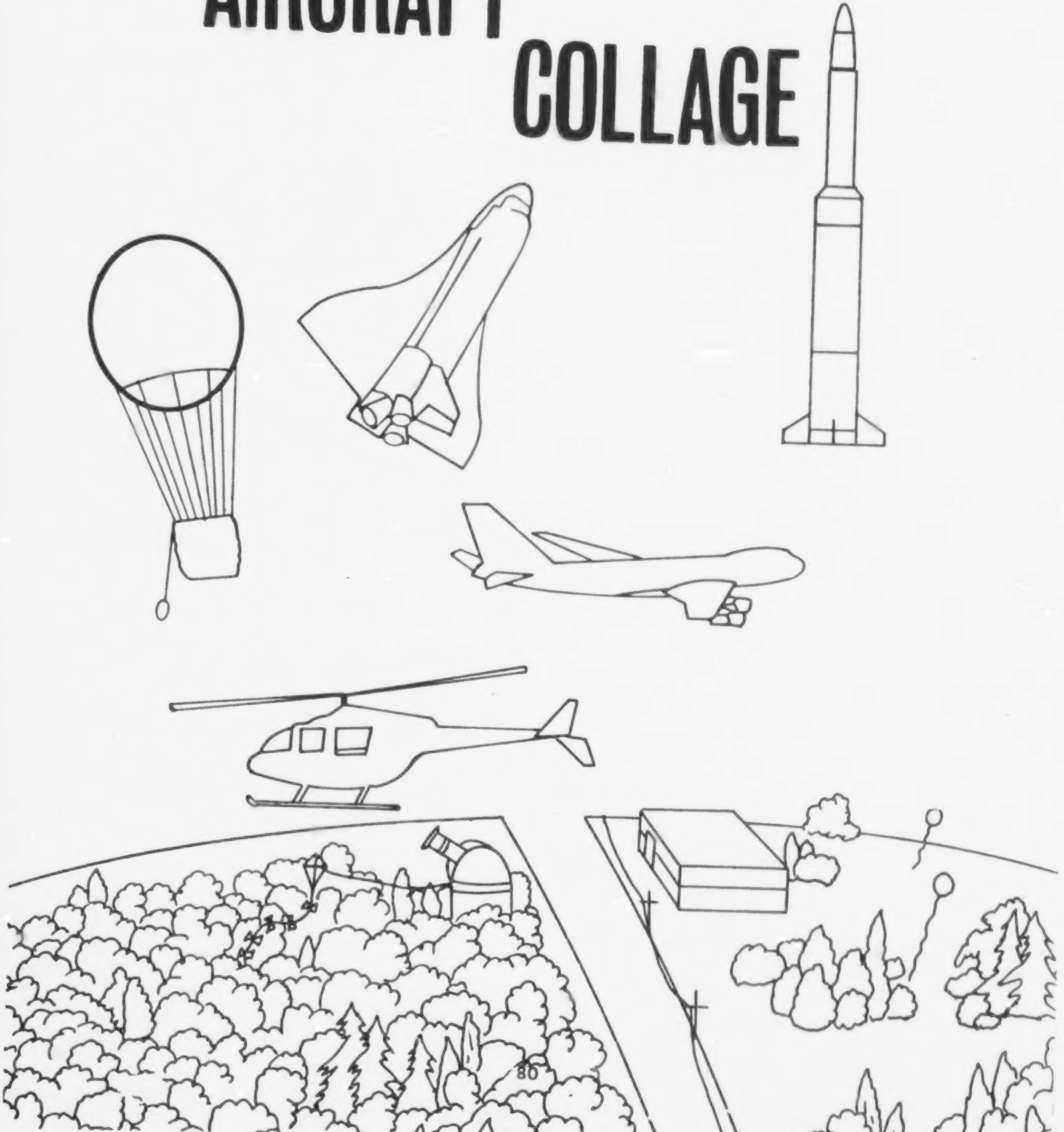
Did you ever see a rocket, a rocket, a rocket?
Did you ever see a rocket go this way and that?
Go this way and that way, go this way and that way,
Did you ever see a rocket go this way and that?
(repeat using aerospace terms)



Laminate the tangram rocket shape onto the file folder. Cut out a second set of shapes. Allow the child to match the shapes. For younger children shapes can be colored to match.



AIRCRAFT COLLAGE



NAME: Aircraft Collage

SUBJECT/SENSE: Math (Sight)

SKILL: Develop ability in visualization and classification

PROCEDURE:

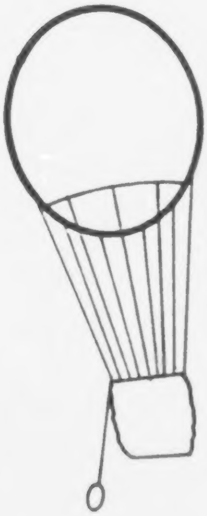
1. The teacher can color and laminate the collage on the folder. Then ask the children to name the things that fly. This will increase the childrens' revisualization skills and reinforce their awareness of aircraft.
   Materials: folder game activity, colors, markers

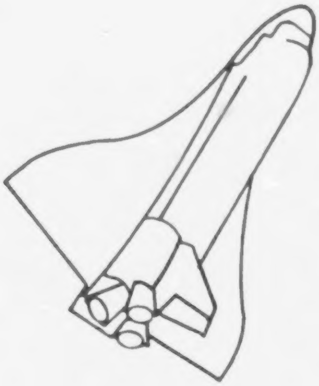
2. The teacher will color and laminate the cards of Things That Fly and Things That Do Not Fly. Then she will talk about what the objects represent and let the children classify accordingly.
   Materials: folder game, patterns, scissors, markers

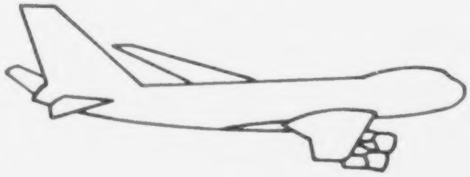
PARENT/CHILD EXPERIENCE:

The parent will help your child cut out magazine pictures or draw pictures of things that fly. Using a variety of media (colors, paint, drawings, pictures, etc.) encourage your child to make the collage as creative as possible. The child's concept of things that fly will be enhanced.
Materials: magazine, paper, scissors, markers, available drawing tools

OBJECTIVE: Create a collage



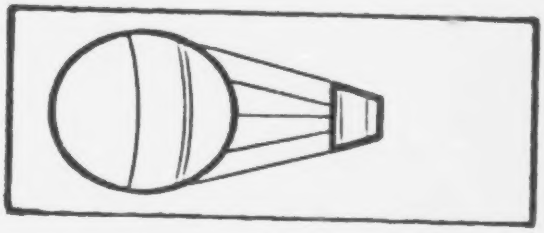


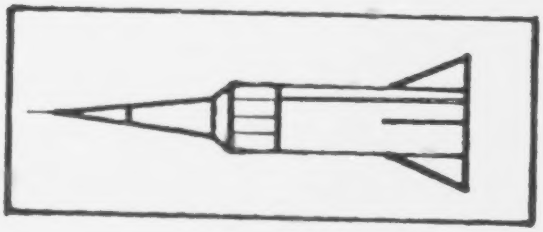


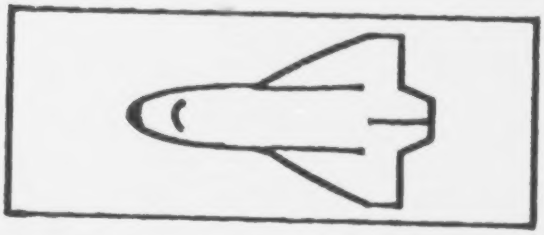
CLASSIFICATION

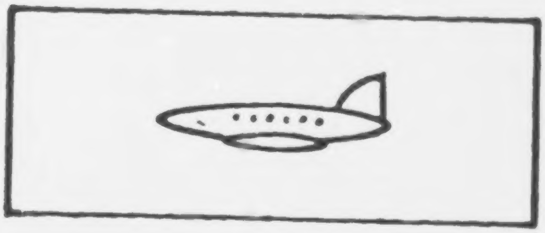
The child looks at the picture card. He decides which group that it goes with. He puts the card into that set. Symbols or words on the back of the card correspond to the correct envelope to make the game self-correcting.

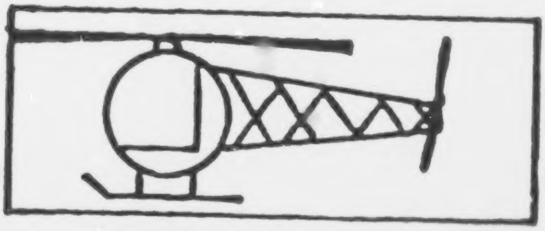
THINGS THAT DO NOT FLY



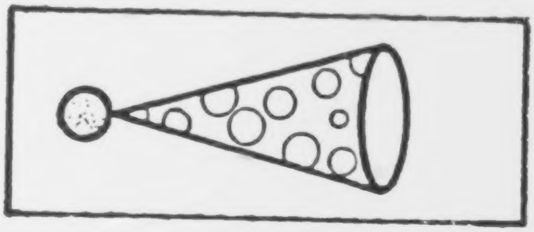


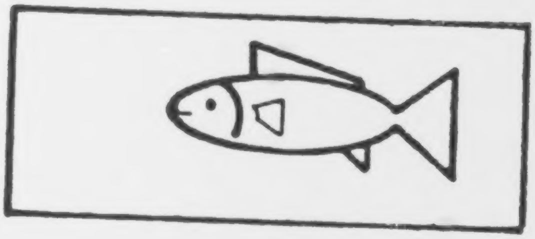


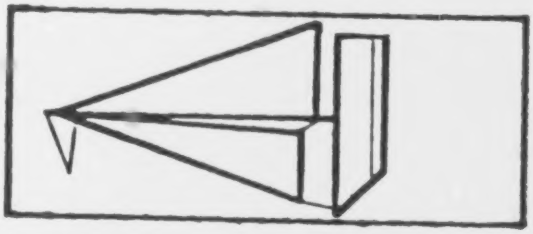


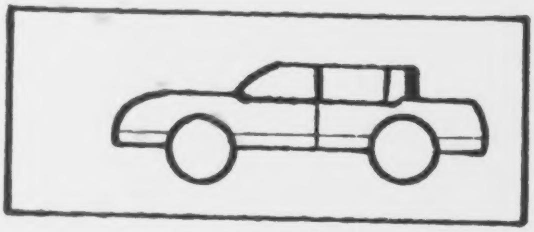


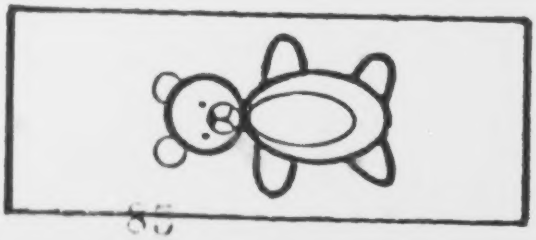
THINGS THAT FLY











TRIP TO THE MOON

NAME: Trip to the Moon; Blast-Off

SUBJECT/SENSE: Math (Sight)

SKILL: Become aware of the moon as an object in the sky with a surface, reinforce skills

PROCEDURE:

1. The teacher can make the board game and place any skill on the game board (numbers, letters, math facts, colors, etc.) If the game board is laminated prior to placing the skills on the blank spaces, it may be used over and over, substituting the skills as needed. Markers or crayons can be used directly on the laminated surface and erased or blank stick-on labels can be used. The numbers can be cut out, placed in a cup and the children can pick a number and move the indicated number of spaces or a die may be used. The children can play the board game to see who gets to the moon first.
   Materials: folder game pattern, markers, glue

2. The teacher can teach the song "Trip To The Moon" to the tune of "She'll Be Coming 'Round the Mountain"

   They'll be coming 'round the planet when they come, zoom, zoom
   They'll be wearing their new space suits when they come, zip, zip
   They'll be riding the Space Shuttle when they come, shush, shush
   They'll be stopping at the space station when they come, stop, stop

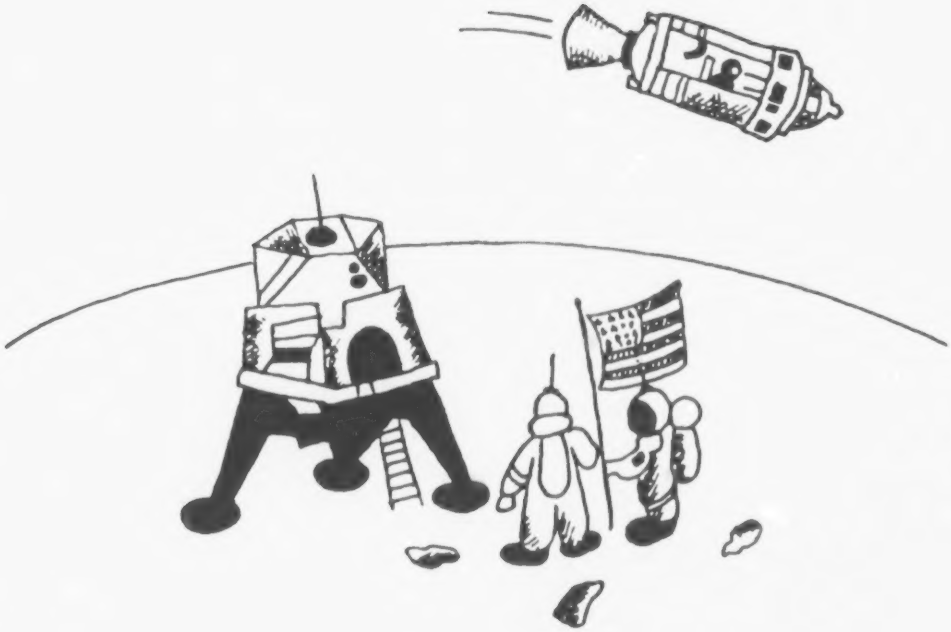
3. The teacher will collect different types of rocks and dirt with the children. Then the children can compare the sizes, shapes and colors of the rocks. Fill one gallon plastic jug with one kind of soil (about one quart) and water (about three quarts), shake the jug and let it stand. The children can observe the soil layers as they form (rocky and sandy soil form different layers). Compare the texture, consistency and color of the dirt.
   Materials: rocks, dirt, gallon plastic jug, water

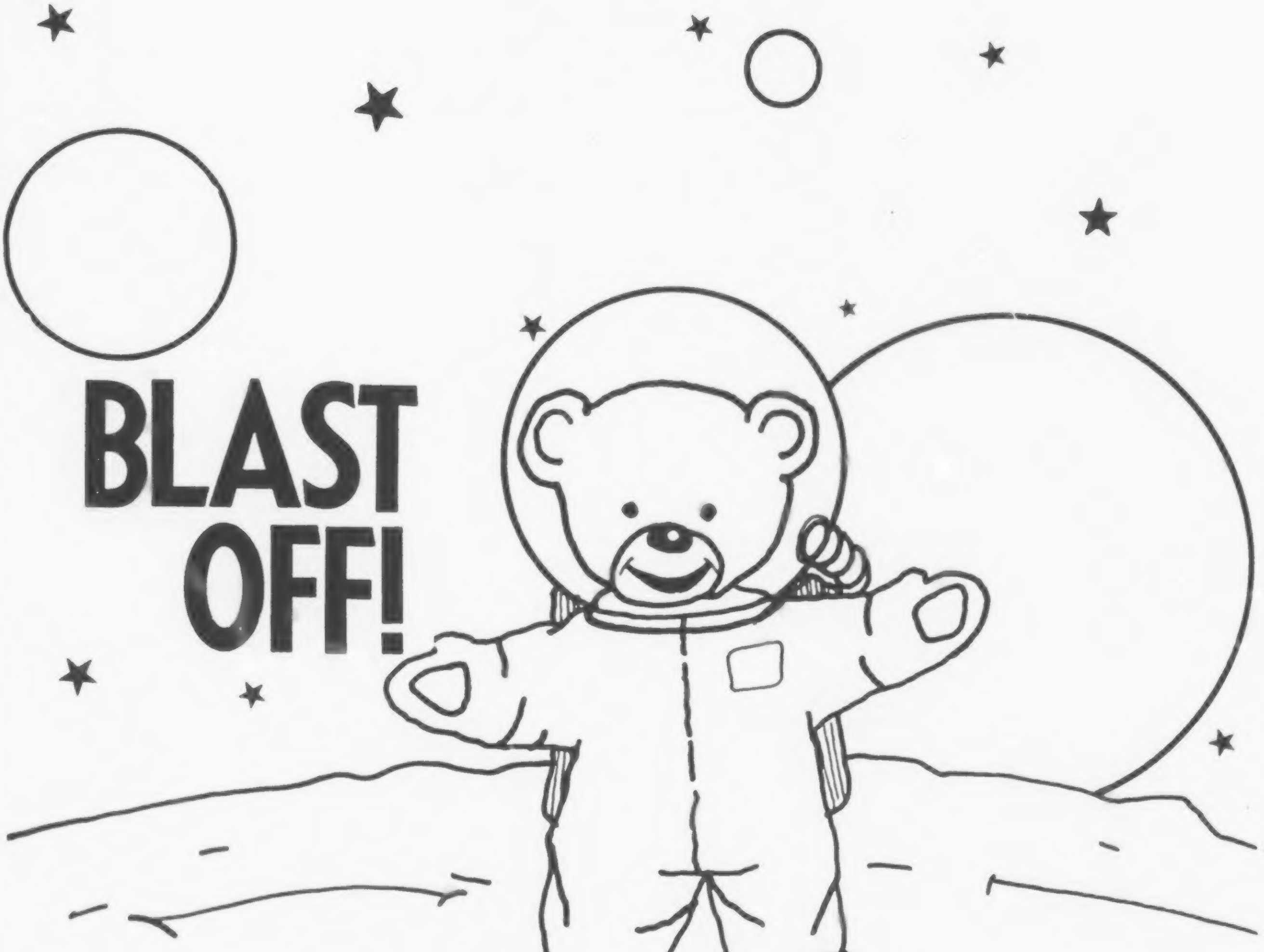
PARENT/CHILD EXPERIENCE:
Observe the moon phases at night with your child. Talk about how the moon changes shapes. Encourage your child to draw these shapes.

OBJECTIVE: Observe the moon

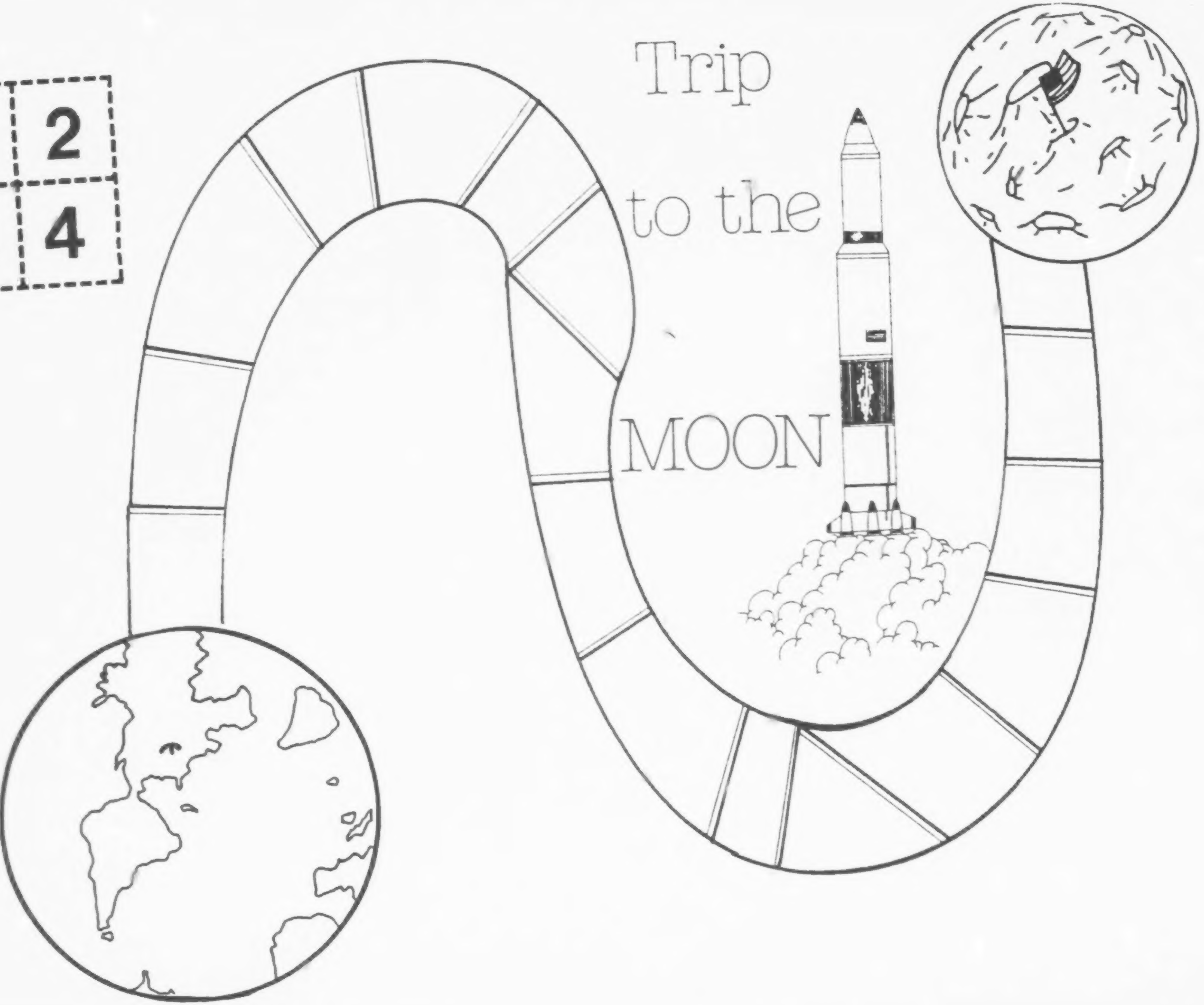
BACKGROUND INFORMATION:

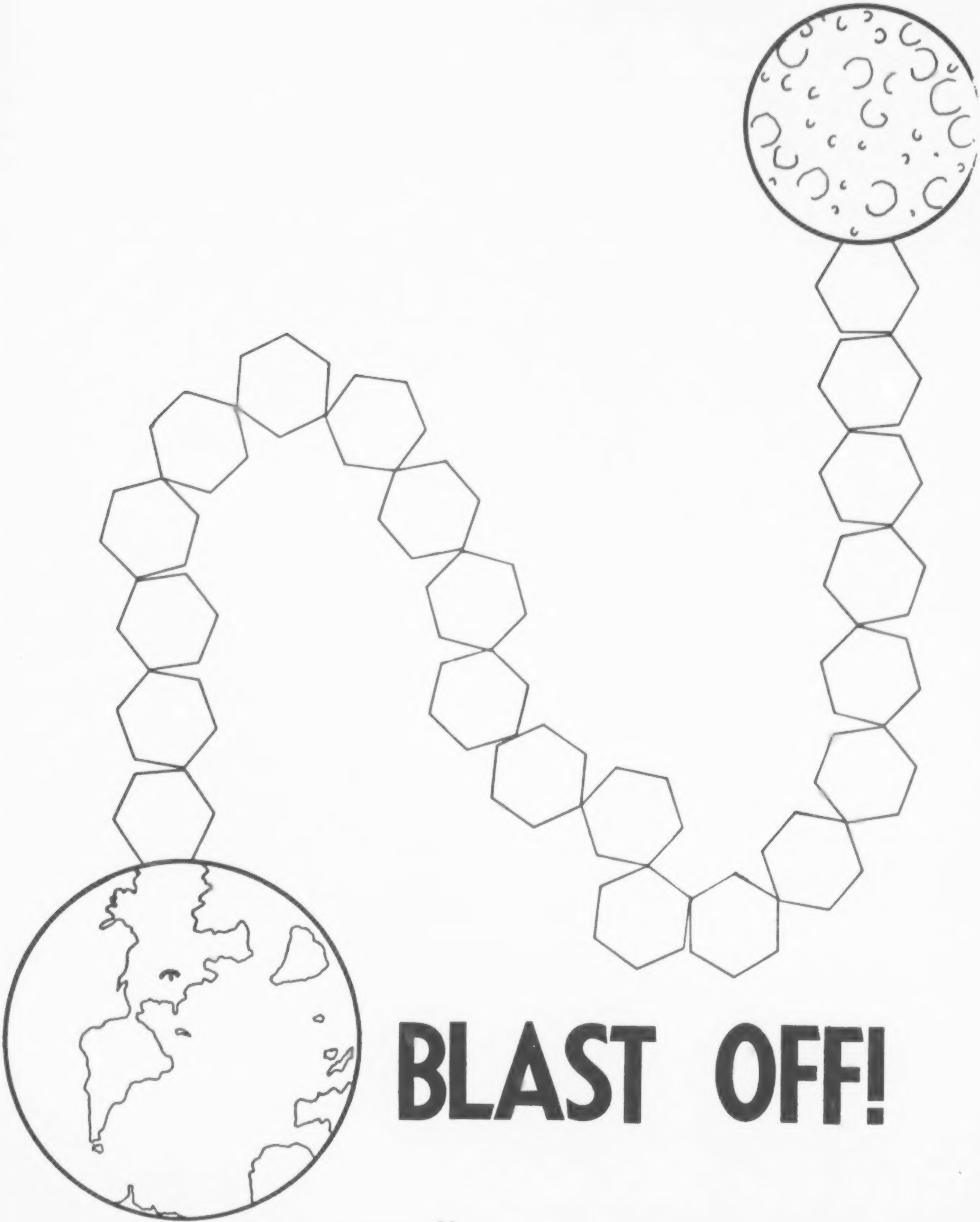
There were 12 astronauts that landed on the moon and collected dirt and rock samples. There were six landings of Apollo (11, 12, 14, 15, 16, 17) on the moon. Many scientific studies were made. One experiment was dropping a hammer and a feather. They landed at the same time because there was no air resistance. (Teachers can obtain a lunar soil certification from NASA workshops and check out the moon rocks to show their students.)



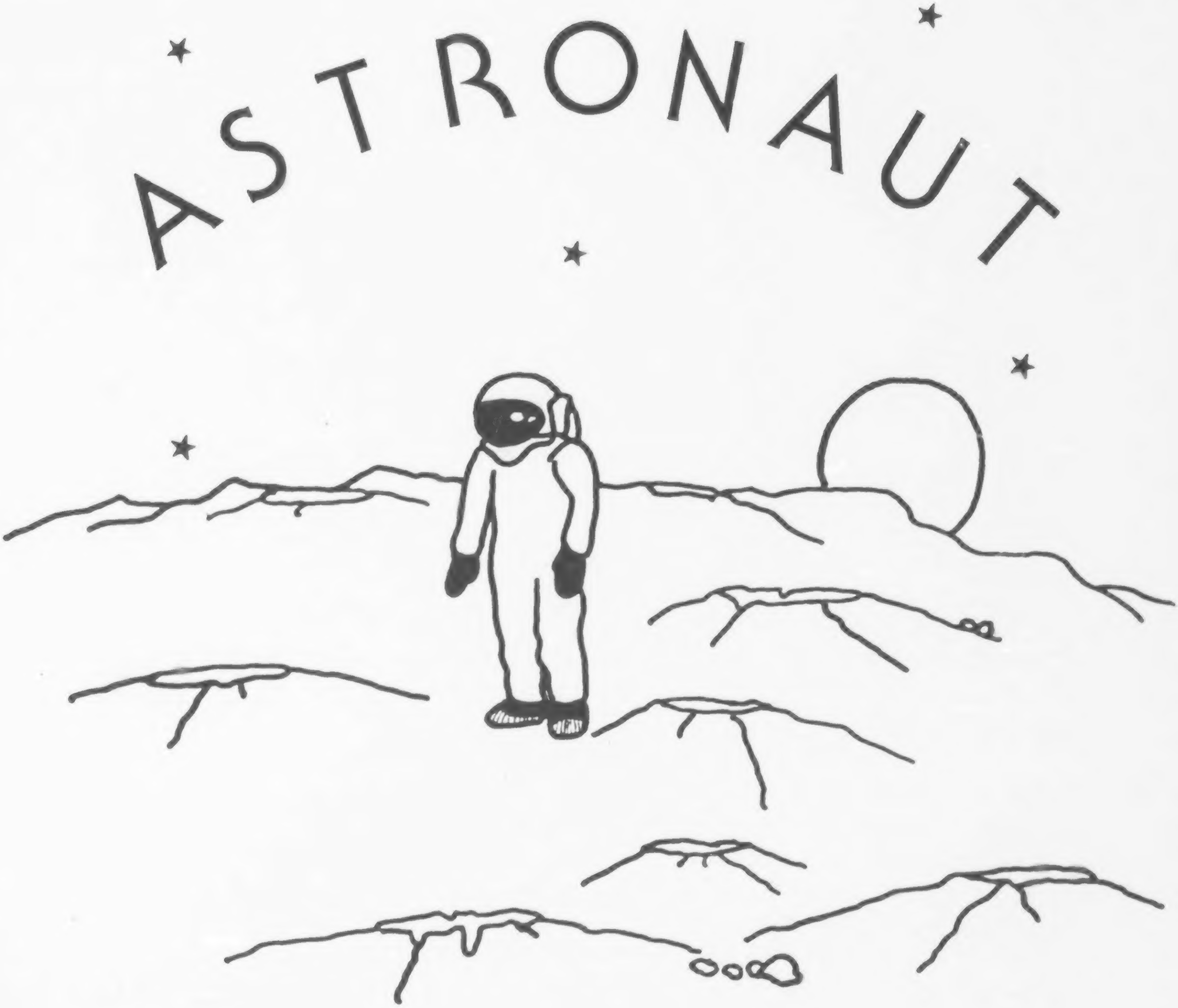

BLAST OFF!

1	2
3	4


Trip
to the
MOON



BLAST OFF!


ASTRONAUT

NAME: Astronaut

SUBJECT/SENSE: Math (Sight, hearing)

SKILL: Form sets to 10

PROCEDURE:

1. The teacher can glue the astronauts to file folders and laminate them for durability. The "Astrosticks" can be glued to popsicle sticks or a paper ring can be glued to the back to create a finger puppet. The teacher will read the poems to the children and then have them repeat. The children can use the astrosticks or astropuppets to act out the poems.
   Materials: astronaut patterns, file folder, markers, scissors

2. The teacher will make the set cards. She will color the sets, laminate and cut out. The children will match the number word with the numerals reinforcing the concept of numeration to 10.
   Materials: folder patterns, markers, scissors

3. Encourage the children to dramatize the landing on the moon. Buzz Aldrin and Neil Armstrong were the first men on the moon. Talk about this event.
   Materials: pictures of this event can be obtained from NASA (See Resources)

PARENT/CHILD EXPERIENCE:

With your child make a moon landscape. Place small objects on a piece of cardboard or other hard surface. Cover with tin foil. This will create a surface of craters and moun- tains. Purchase 10 small toy astronauts, space ships, etc. and encourage your child to act out the moon landings.
Materials: tin foil, cardboard, small objects, toy astronauts

OBJECTIVE: Create a surface representing craters and mountains

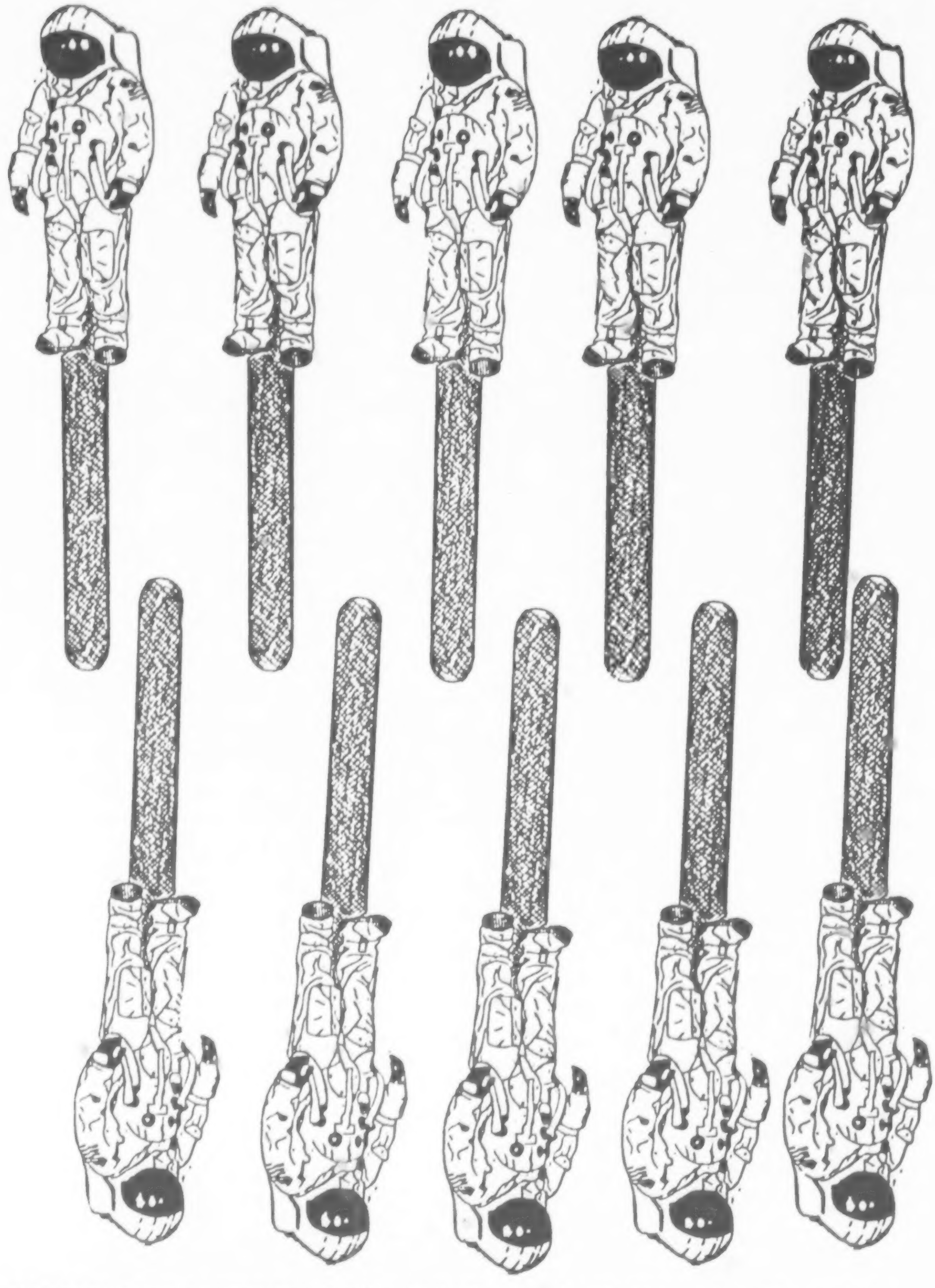
BACKGROUND INFORMATION:

The original 7 astronauts in the Mercury Program were: Sheppard, Grissom, Glenn, Carpenter, Schirra, Cooper and Slayton. The Gemini Program flew 20 astronauts and the Apollo Program flew 33 astronauts. Through the end of 1991 there have been 132 crew members to fly aboard the Space Shuttle. Some astronauts flew on several of these missions.

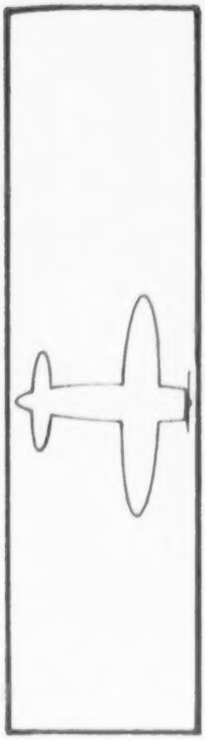
TEN LITTLE ASTRONAUTS (Tune: Ten Little Indians)

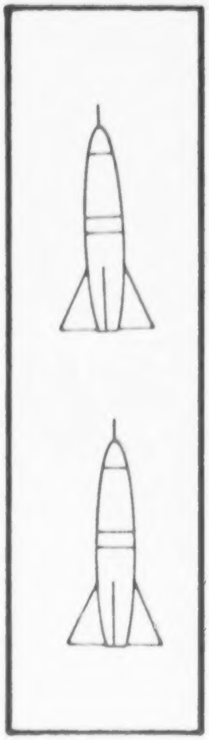
One little, two little, three little astronauts,
Four little, five little, six little astronauts,
Seven little, eight little, nine little astronauts,
Ten little astronauts, boys and girls.

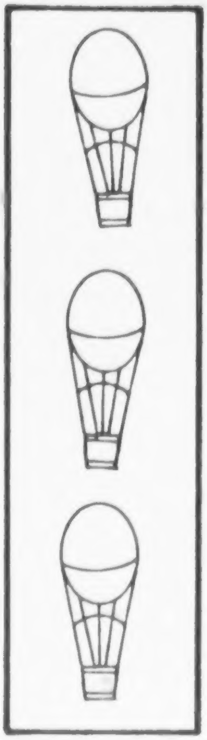
TWO LITTLE ASTRONAUTS
Two little astronauts are going to the moon.
Two little astronauts hope they'll get there soon.
The first one said, "Oh, this is such fun."
The second one said, "We will see the sun."
Then--10,9,8,7,6,5,4,3,2,1,ZOOM!

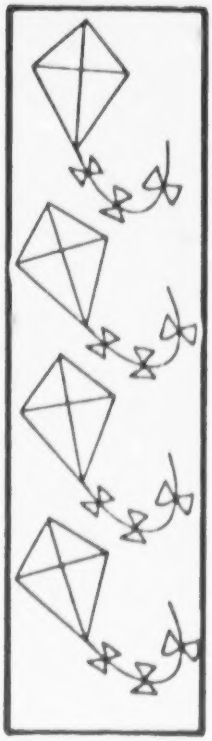


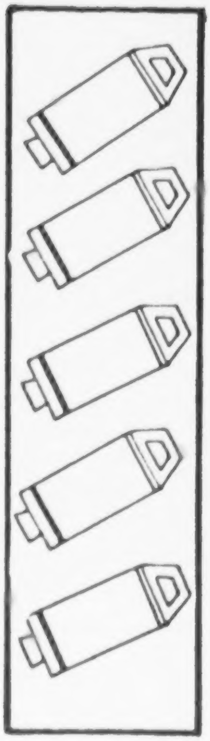
Personal items aboard the Orbiter including food selections are color-coded as follows: Commander - Red; Pilot - Yellow; MS1 - Blue; MS2 - Green; MS3 - Orange; MS4 (PS1) - Brown; MS5 (PS2) - Purple

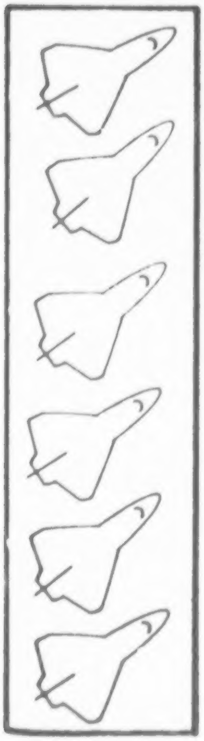


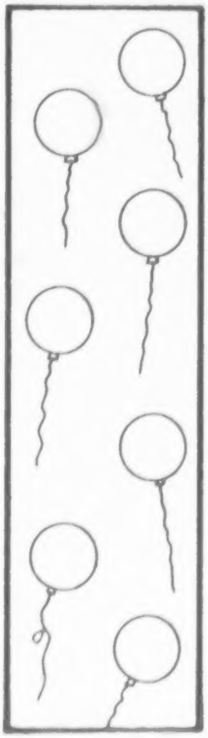


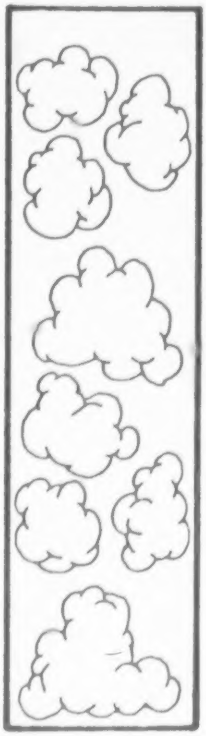


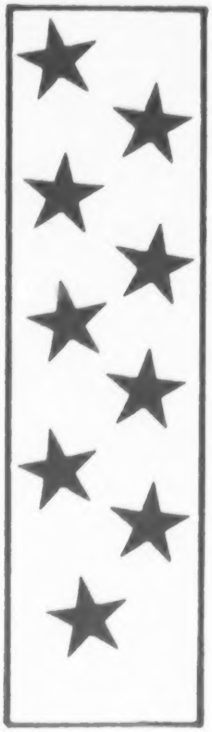








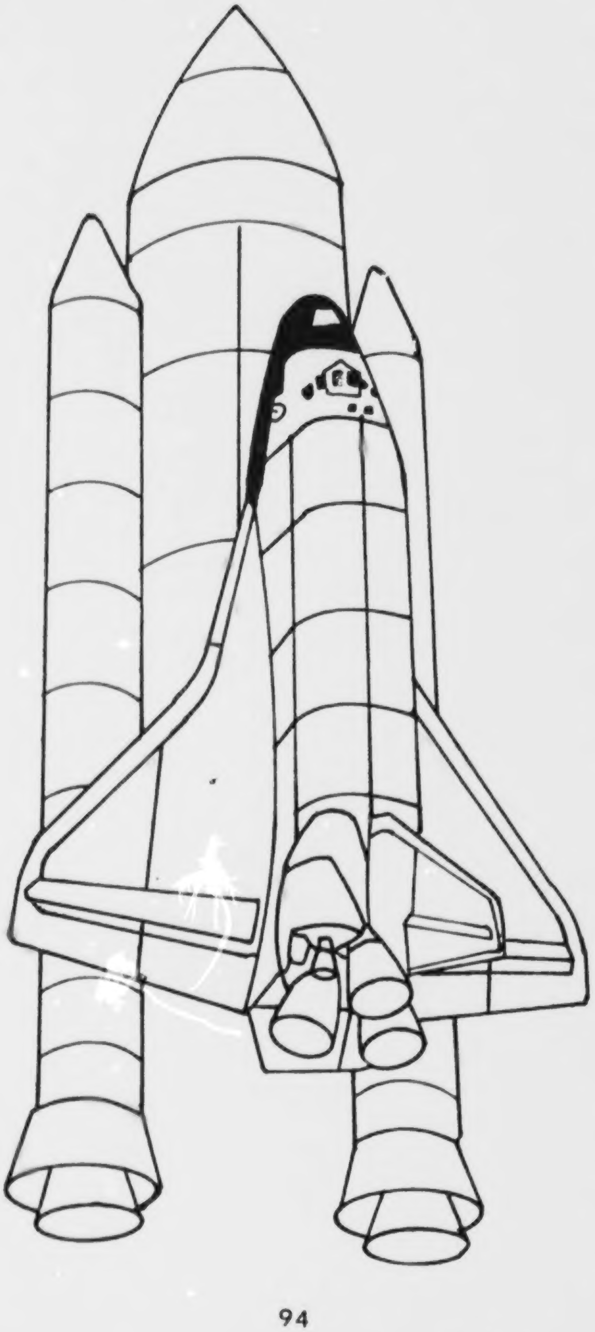




Count the number in each set. Place the set cards in numerical order from 1 to 10 or from 10 to 1.

SPACE . . .

SENSATIONS



NAME: Space Sensations

SUBJECT/SENSE: Science (Taste, Smell, Touch, Hearing, Sight, Sound)

SKILL: Become aware of the senses (for safety and enjoyment)

PROCEDURE:

1. The teacher can discuss how an astronaut feels during the blast-off. The astronauts are on their backs and the Shuttle vibrates and shakes. The children can sit in a chair and the teacher can gently shake the chair to give them the sensation vibration. As the Shuttle goes into space a pressure is applied toward the body. The children can go outside and simulate this experience with a swing. As they swing forward they can feel the pressure. At the top of the swing there is a moment of weightlessness, resembling what you would feel like in space.
   Materials: chair, swing

2. Astronauts have to go through the same daily routine that they do on earth. They must rest by strapping themselves in a sleeping bag so they won't float around the Shuttle. They can sleep in any direction since there is no gravity. On earth we must lay down to rest the heart. At rest time lay a strip of paper across the children. As they lay on their mat or towel have them pretend they are sleeping in space. An eye mast may also be used to block out light since astronauts see daylight every 45 minutes.
   Materials: scrap material, elastic or string attached to the ends.

3. Tape record different sounds as you and the children go for a walk. Have the children identify the sounds as you play the tape. Astronauts carry tape recordings of their favorite music to play in space. One of the astronauts favorite tapes on the Shuttle was a tape of earth sounds; birds singing; waves at the beach; leaves rustling, etc.
   Materials: tape recorder, tapes

PARENT/CHILD EXPERIENCE:

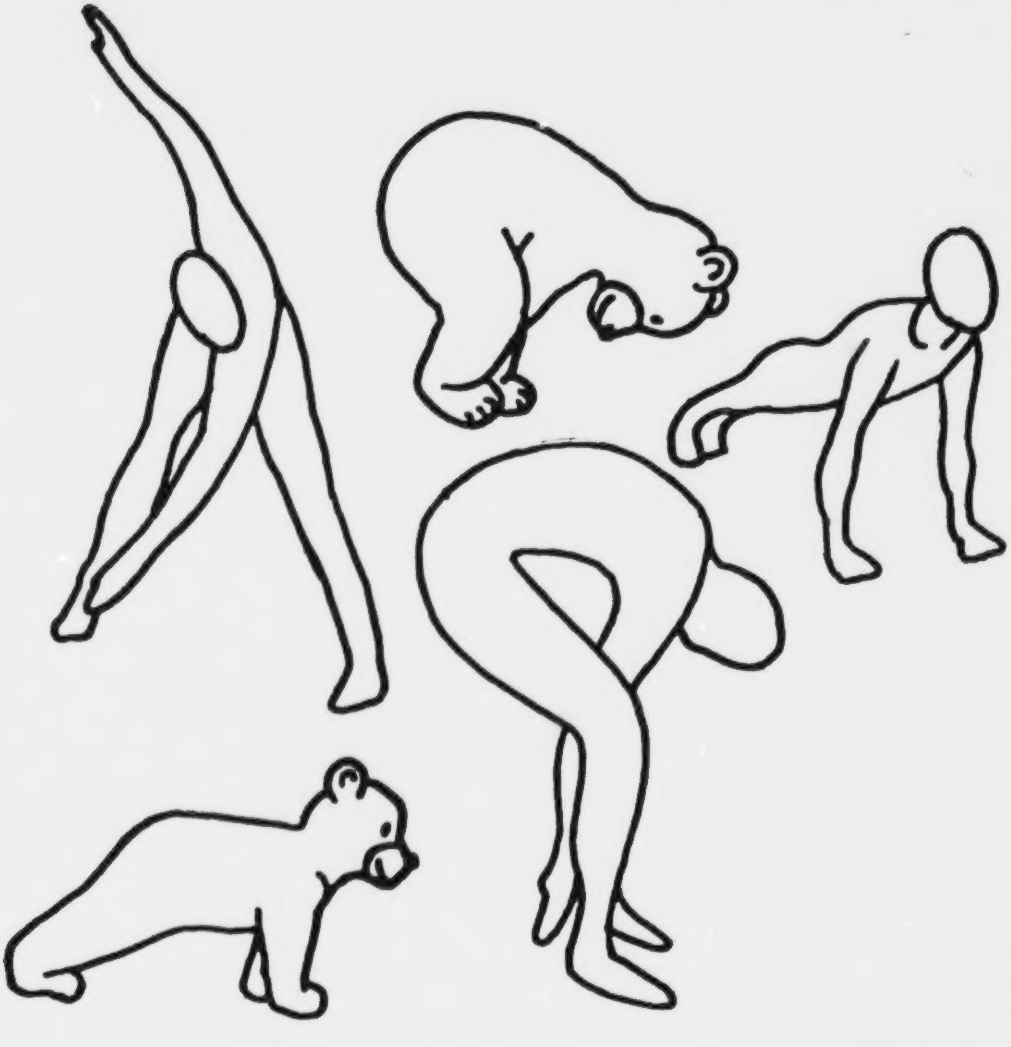
The astronauts see a sunrise and sunset every 45 minutes as they orbit the earth. An astronaut's day is the same as a day on earth--there are still 24 hours in a day, however, we see the sunrise and sunset at different times. With your child, watch the sunrise and sunset. The child will learn the day (sun) and night (dark) concept.

OBJECTIVE: Observe a sunset and/or sunrise

BACKGROUND INFORMATION:

Astronauts brush their teeth and bathe in space differently than on earth. They can swallow their toothpaste or spit it in a towel, but they can't spit it into the sink. They wash their hands and faces with sudsless or regular soap and wet a washcloth from a pressurized water hose.

SPACE MOVEMENT



NAME: Space Movement

SUBJECT/SENSE: Science (Touch), Kinesthetic

SKILL: Become aware of the importance of physical fitness, develop exercise techniques

PROCEDURE:

1. The teacher can talk about how important it is to be physically fit to travel in space just as it is on earth. Ask the children to play like they are an astronaut. They must learn to exercise in a limited space. Have them pretend they are in a small capsule or Shuttle and need to do some exercises.

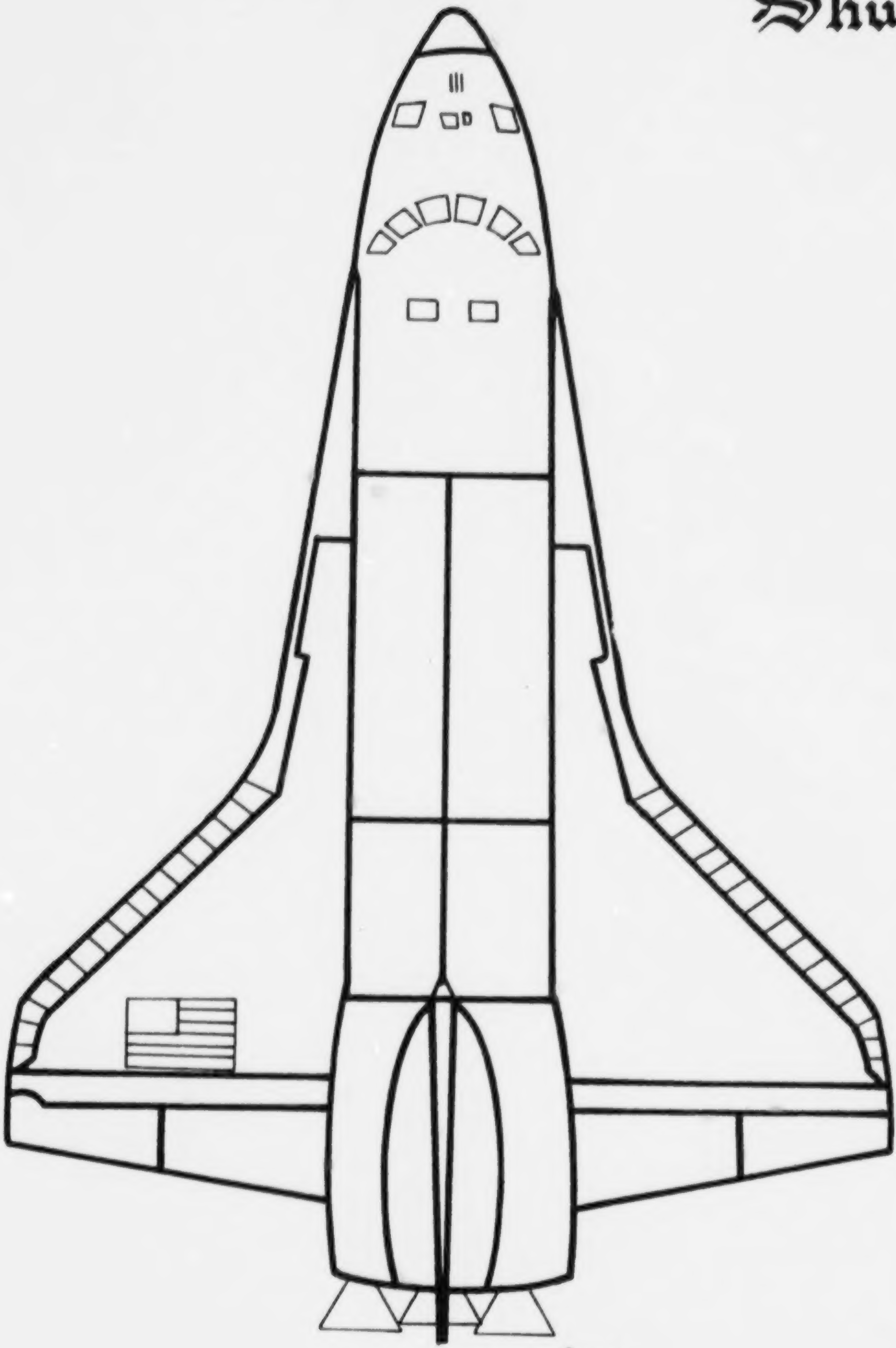
2.. Have the children sit in their chair and push their seat with their hands lifting their bottom up. Next have them push their hands together in front of their chest, then, lift their body up straight, like there is a puppet string pulling them up then relax and slump down in their chair. Can you think of other exercises?
Materials: Chair

PARENT/CHILD EXPERIENCE:
Astronauts train in their space suits in a huge swimming pool at Johnson Space Center in Houston, Texas. They try to get the feeling of what it would be like in space. Have your child play like he is floating like an astronaut in a swimming pool or bath tub.

OBJECTIVE: Float in water

BACKGROUND INFORMATION:
The original astronauts had to be extremely physically fit, but today almost any healthy person will be fit enough to travel on the Shuttle.

Space Shuttle



NAME: Space Shuttle

SUBJECT/SENSE: Math (Sight)

SKILL: Become aware of limited space

PROCEDURE:

1. The teacher will help the children build a Space Shuttle in the classroom. Let the children take turns working or playing in the shuttle. They will learn about working in a confined space.
   Materials: Space Shuttle mock-up

2. The teacher can make the dot-to-dot Shuttle folder game, laminating the surface so it can be used as a wipe-off card. The children can use a crayon to complete the Space Shuttle dot-to-dot folder game learning the numerals to 11. This will encourage the children to draw a space Shuttle and create their own drawings of a spacecraft. You can also show the children different pictures of the Shuttle.
   Materials: folder game shuttle, crayons, Shuttle photos (See NASA Resources)

3. The Shuttle orbits (goes around the earth) about 180 to 250 miles above the earth. From space we can see the earth. The earth will be brown and green and the water (oceans, lakes) will be blue. White clouds would cover parts of the earth and water. You can even see the contrails (white trails) of airplanes and wakes of ships. The teacher can discuss this concept with a child by looking at a globe. Cotton can be glued to simulate the white.
   Materials: globe, cotton, glue stick

4. As the children look at a globe, they can draw pictures of the earth, as they imagine it would look like to an astronaut from space. Such songs as the following could introduce the concept of this being a small world.
   Materials: "We Are The world" (commercial); "It's a Small World" Walt Disney Productions, US.A., Western Publishing Co., 1968; "Travelin" With Ella Jenkins' New York: Folkways Records and Service Corp., 1979. (Ella introduces the word "hello" in several languages).

5. Children can assemble, decorate and have contests flying Thunder Bee Gliders (mini shuttles @.30) Request order form from GBB Thunder Bee Gliders, Grivno Acres, So. Minn. St., P.O. Box 694, Crookston, MN 56716 (218) 281-4690. Or, build their own shuttle with styrofoam meat trays using the following pattern.
   Materials: styrofoam meat tray, scissors, pattern, paper clip

PARENT/CHILD EXPERIENCE:

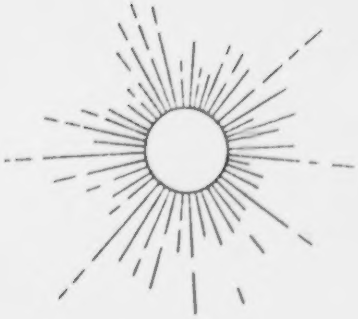
The parent can set up a tent at home and let your child participate in various activities-- eating, paper work (coloring, etc.), playing, etc. Your child will learn about living in a confined space. Compare this to living and working in Space Shuttle.

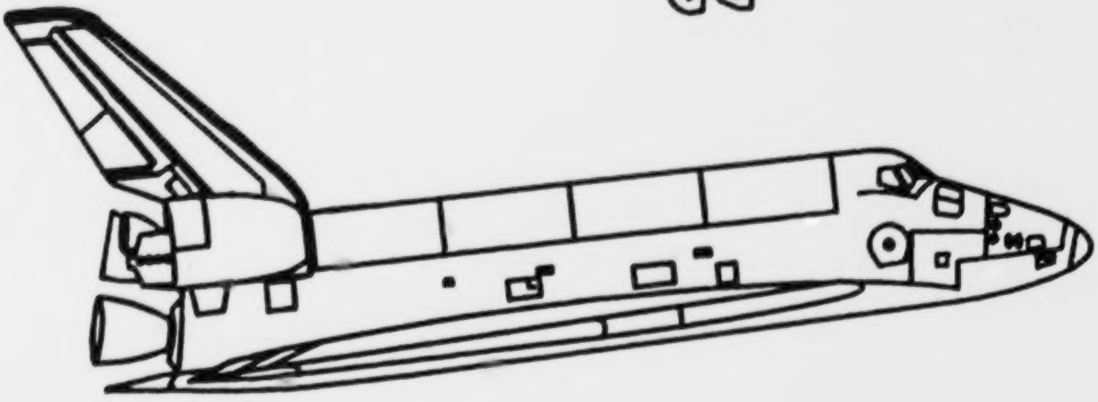
Materials: Bed sheet

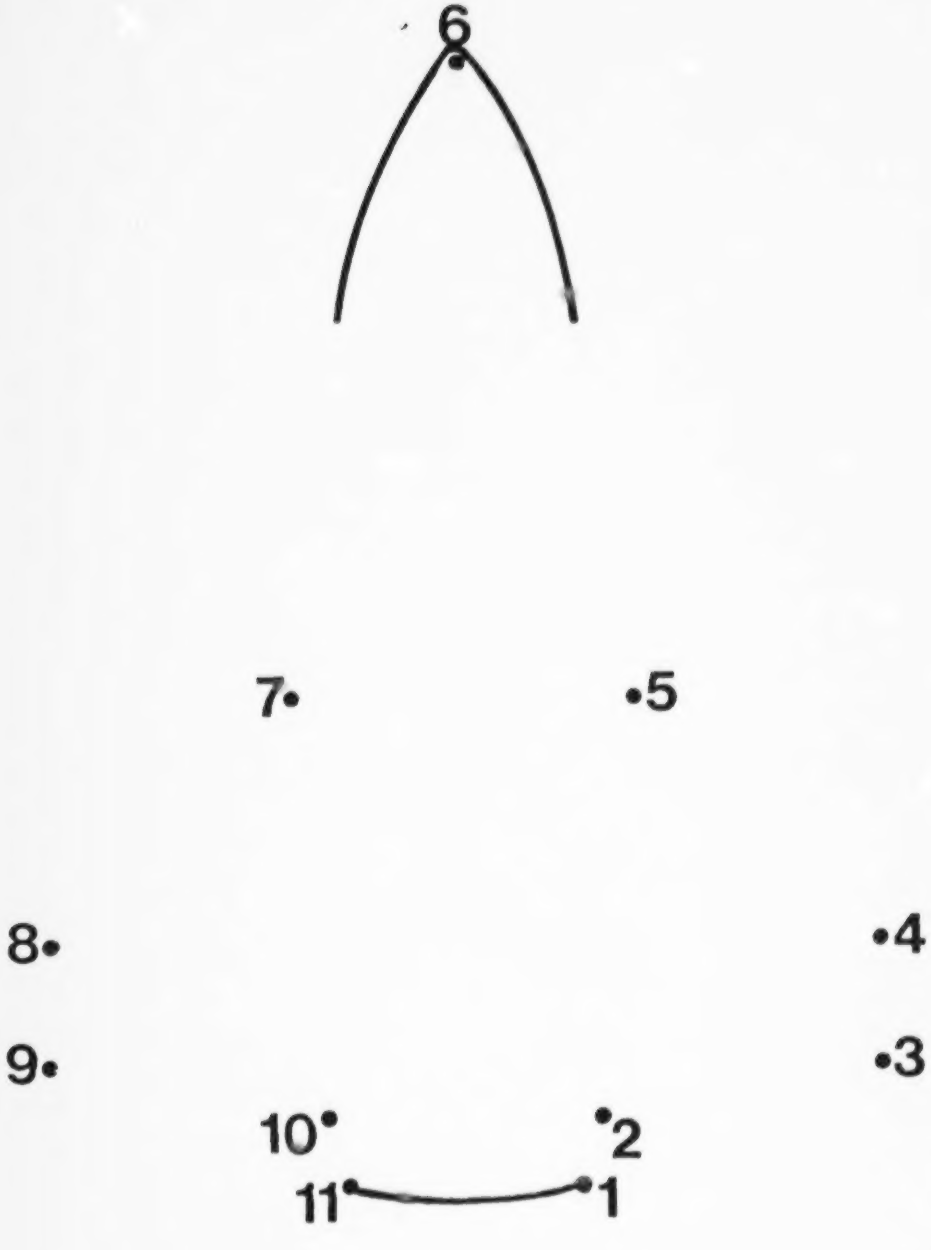
OBJECTIVE: Create a tent and become aware of limited space

BACKGROUND INFORMATION:

While the Apollo program was in progress, a Space Transportation System of which the Shuttle orbiter is the manned portion, was developed. Most of the expensive parts are returned to earth, thus allowing more flights at a lower cost. The Shuttle comes back to earth where the early spacecraft could not. Tell the children when they grow up it will be possible to travel in space to space stations and maybe to other planets.






6
7
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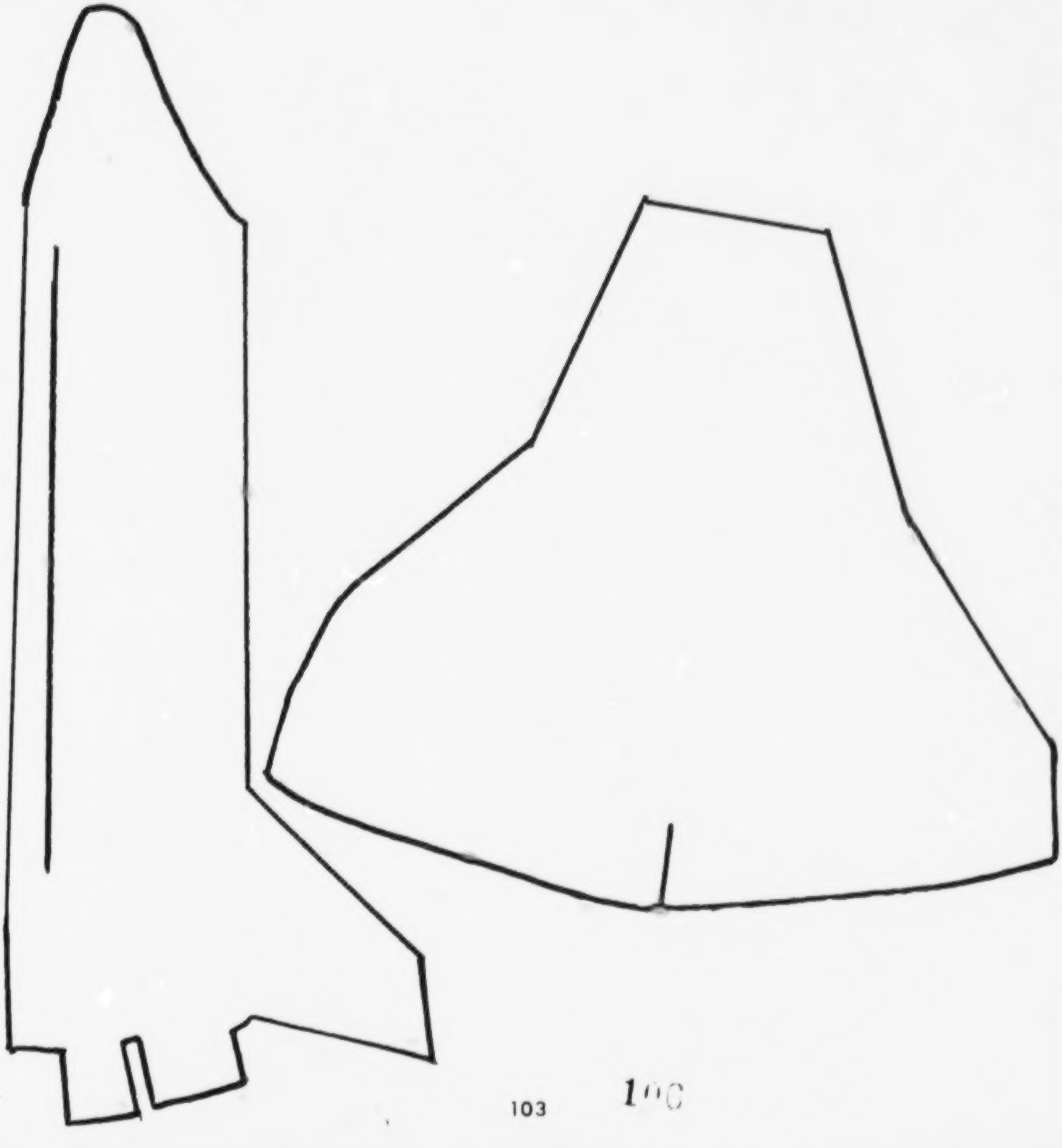
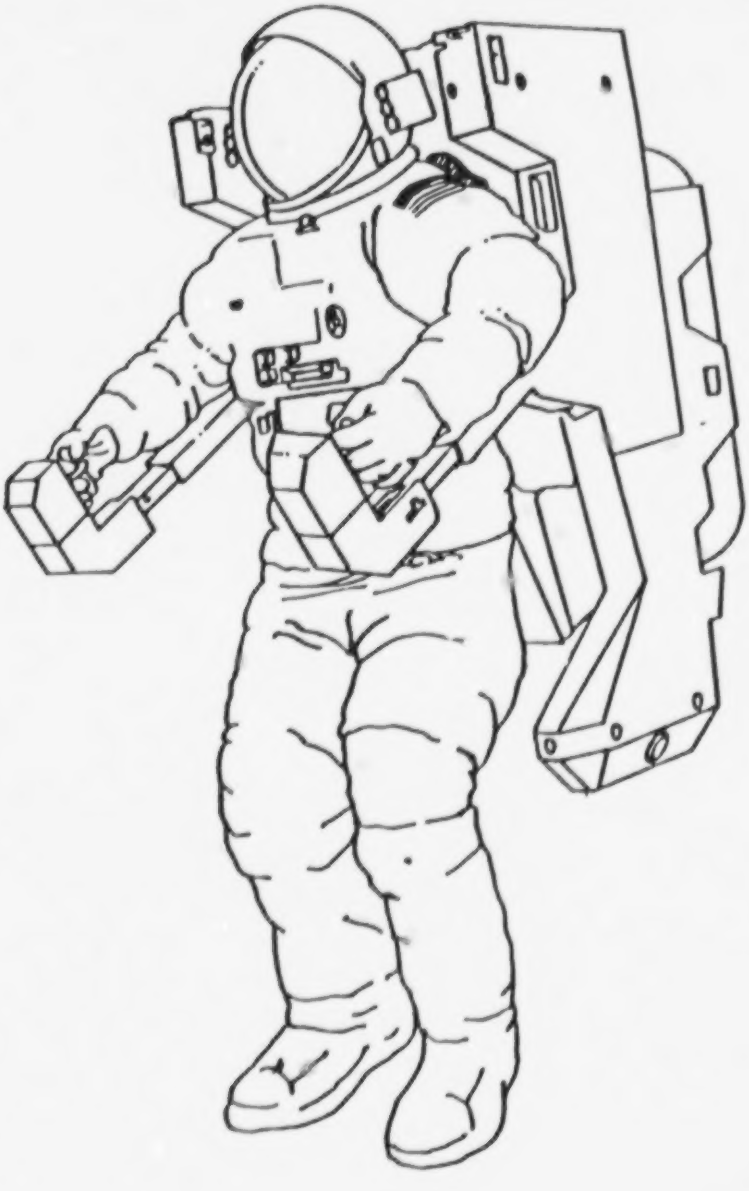
11
1

SPACE SHUTTLE MODEL

Cut out the shuttle pattern and trace on styrofoam meat tray.
Cut out styrofoam shuttle.
Cut the wing slot on the body to hold the front of the wing in place.
Attach paper clip on nose to give weight to insure stability.



SPACE SUITS



NAME: Space Suits

SUBJECT/SENSE: Science (Touch)

SKILL: Become aware that clothing is for protection and comfort

PROCEDURE:

1. The main difference on the astronauts clothes worn on board the Shuttle is the many pockets and attachments to hold their small items, such as scissors, tools, pencils, and utensils. If they sat something down, it would float away because of apparent weighthlessness! As the children pretend they are an astronaut, remind them to keep their things attached to their clothes or in their pockets. Strips of cloth one inch wide and two inches long can be sewn or safety pinned at the ends to old clothes.
   Materials: Cloth strips, safety pins or needle and thread (Velcro strips are used on the Shuttle)

2. Show the children the picture of the space suit. (This is the extra vehicular space suit worn as the astronauts leave the Shuttle to do experiments in space.) Ask them to see how many parts they can identify. Find the helmet, gloves (hands) and arms.
   Materials: folder game pattern

3. Although the Shuttle is reusable (returns to earth and goes into space again) many items aboard are disposable. Discuss the difference between reusable, disposable and recycleable and different disposable items that could be recycled. An example is a milk jug made into a space helmet. Cut out a place for the eyes and cover with colored cellophane. If you attach red cellophane the children will see their entire environment red--not just an item in the environment. Then you can attach blue over the red, creating purple and the children will learn primary and secondary colors: red and blue make purple, yellow and blue make green, red and yellow make orange.
   Materials: colored cellophane, plastic milk jug or round gallon container or paper sack

PARENT/CHILD EXPERIENCE:

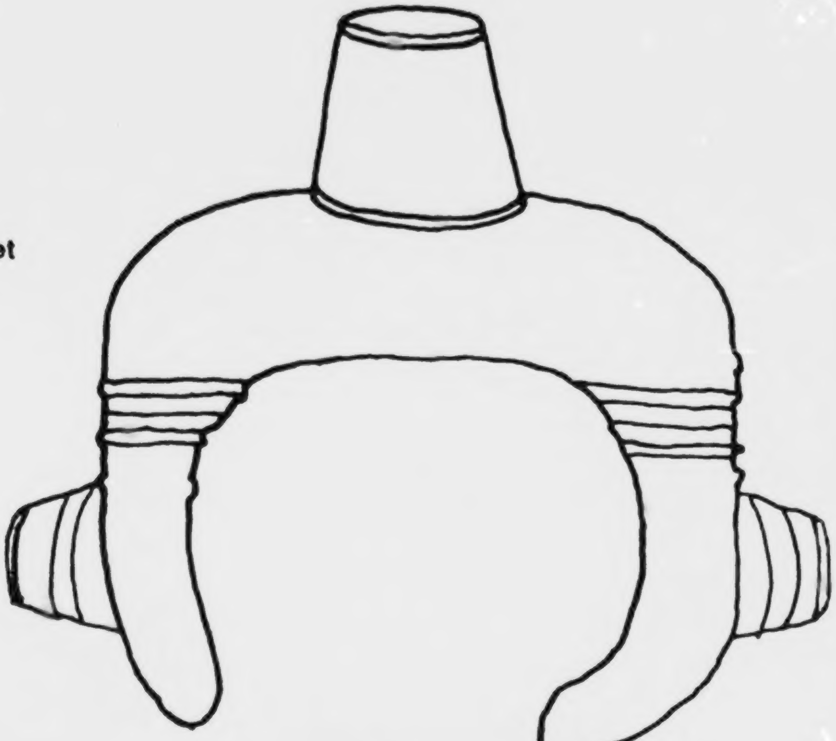
Talk with your child about how layers of clothing insulate the body to keep you warm. The astronauts traveling on the moon needed insulation because there was no atmosphere and they needed to keep their body temperature constant so they would not die. To introduce the concept of insulation, let your child touch a cold object, i.e. ice, with his bare hand. Then let him touch the same object wearing a glove. Ask him to compare the feelings. Astronauts also needed an air supply since there was no oxygen to breathe. Oxygen tanks can be made from plastic coke bottles or oatmeal boxes, yarn, and plastic tubing (3 feet-l 1/2 per tank--costs less than 50 cents) Let your child dress up as an astronaut, encouraging him to use his imagination.

OBJECTIVE: Dress up as an astronaut for dramatic play

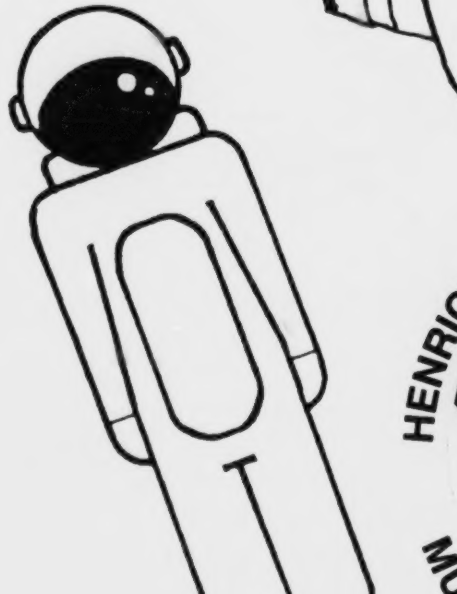
BACKGROUND INFORMATION:

People wear clothing for protection and comfort. Clothing has to be changed when it gets dirty. Astronauts wear the same kinds of clothes in the Space Shuttle that they do on earth. However, they may wear shorts and a shirt or a jump suit with long pants depending on how comfortable the temperature is to them. The Shuttle's inside temperature is about 73 degrees. Some other kinds of clothing items an astronaut will need include: socks, shoes or boots, underwear, sweater, gloves, hat.

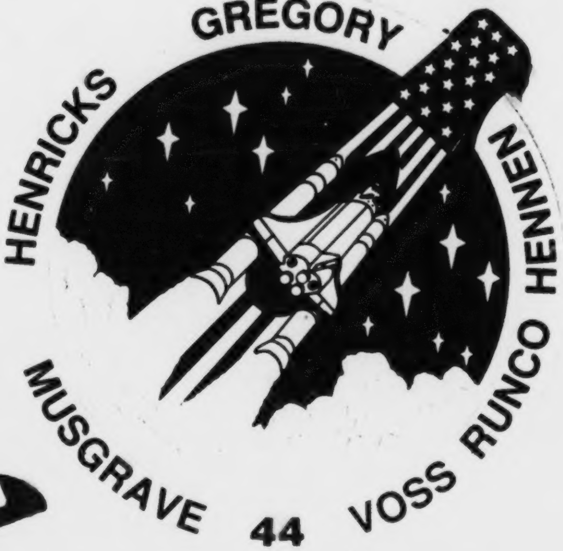
Space Helmet



NASA



Space Suit


GREGORY
HENRICKS
HENNEN
RUNCO
VOSS
44
MUSGRAVE

STS-44 CREW PATCH

Have children, one at a time, lay down on blue butcher paper. Trace around the body up to the neck. Cut out the body outline then draw a NASA patch, a flag, a name card, and the NASA logo on index cards and place accordingly. Have the children put their space suit in front of them with their helmets on.Take pictures for the bulletin board.

SPACE
FOOD

SUBJECT/SENSE: Science (Taste, smell, touch)

SKILL: Become aware of differently prepared foods (dehydrated, compact); become aware of heat, air and water on the texture, taste, odor and appearance of foods

PROCEDURE:

1. The teacher can talk about freeze-dried or dried foods such as Tang. Prepare Tang and compare to fresh orange juice.
   Materials: Tang, water, fresh orange juice, containers

2. To demonstrate the fact that humidity is necessary to prevent dehydration the teacher can perform the following experiment. Using two containers with covers, fasten a piece of freshly peeled apple to the inside of each lid. Pour one-half cup of water into one jar. Do not put any water in the other jar. Fasten the lids on the containers and place them in the sunlight. The apple in the container without any water will dehydrate rapidly. Ask the children to say what they saw.
   Materials: Two containers with covers, apple, water

3. To simulate the way astronauts eat some space foods, puree some food in a blender or make instant pudding and put in a small plastic bag. The change in consistency of some ingredients when they are mixed will be observed by the children. Let the children eat the food as astronauts do. Clip a small hole in one corner of the bag and squeeze the food into the mouth.
   Materials: food, blender or instant pudding and milk, small plastic bag

4. The teacher will place small amounts of raw, canned and dried fruit in separate dishes. The children can compare the difference in a fruit that has been prepared in different ways. Taste the fruit. The children will learn the effects of heat and water on the texture, taste, odor, and appearance of foods.
   Materials: raw, canned and dried fruit, dishes

5. The teacher can remove some of the fruit from commercial cereals containing freeze- dried fruit. Place the fruit in a small bowl with a small amount of water for a few minutes. Measure the water before and after rehydration. The children can observe what happens to the fruit and to the water. Ask them is the fruit still as hard as when it was first placed into the bowl of water.
   Materials: cereal, water

6. Purchase space food from NASA's souvenir shops, if possible. (Contact Kennedy Space Center Visitors Center, if living in the southeast.) Dehydrated food is also packaged as MRE's (Meals Ready to Eat) and found in the military or camping supply stores. Many items eaten on board are now "off the shelf" food found in

local grocery stores: pop top canned fruit and pudding.

PARENT/CHILD EXPERIENCE:

Have your child help prepare balanced meals at home using dehydrated baby food. Talk about the 4 basic food groups. (See parent note)
Materials: dehydrated baby food (Hines or Gerber)

OBJECTIVE: Prepare then compare taste, smell, texture of food

BACKGROUND INFORMATION:

There is no food in space so you have to take it with you. Food in space has to be dehydrated and compactly packed because at blast-off you must have the least weight possible and dehydrated food takes up less space. There is no refrigerator on the Shuttle but astronauts have fresh fruit and vegetables for as long as they stay crisp. Astronauts add water to the dehydrated food when they are ready to eat and heat the food if necessary. If the astronauts aren't careful, some food will float away. Velcro straps or magnets hold the food trays on the walls or on the astronauts' legs. Use a styrofoam meat tray with yarn attached to simulate an astronaut's food tray.

WHAT DO YOU EAT IN SPACE?

About fifty different kinds of foods are available for an astronaut to eat in space. However, he can not use a knife and fork the way we do on earth since there is no gravity. The meat might float right off his plate!

He often squeezes food out of a tube like putting toothpaste on a toothbrush. He can eat bitesized pieces of anything. A typical meal could be like a balanced meal on earth.

An astronaut can store enough food for one week in a package about the size of a shoe box. Most foods are freeze-dried

Study the balanced meals with your parents. Plan a meal that you could eat in space.

Create a balanced meal using dehydraed baby food available at the grocery stores. This product is another spin-off from the technology achieved from the Space Program.

Child Serving

3 milk or milk product

1 meat, fish, poultry, eggs

1 green and yellow vegetables

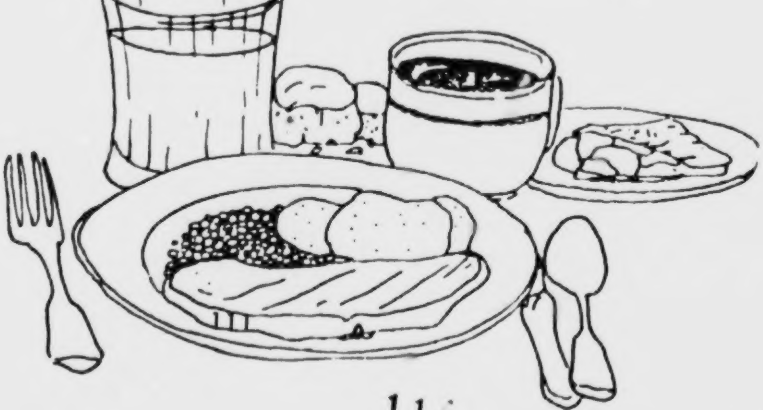
1 citrus fruits and tomatoes

1 potatoes, other fruits and vegetables

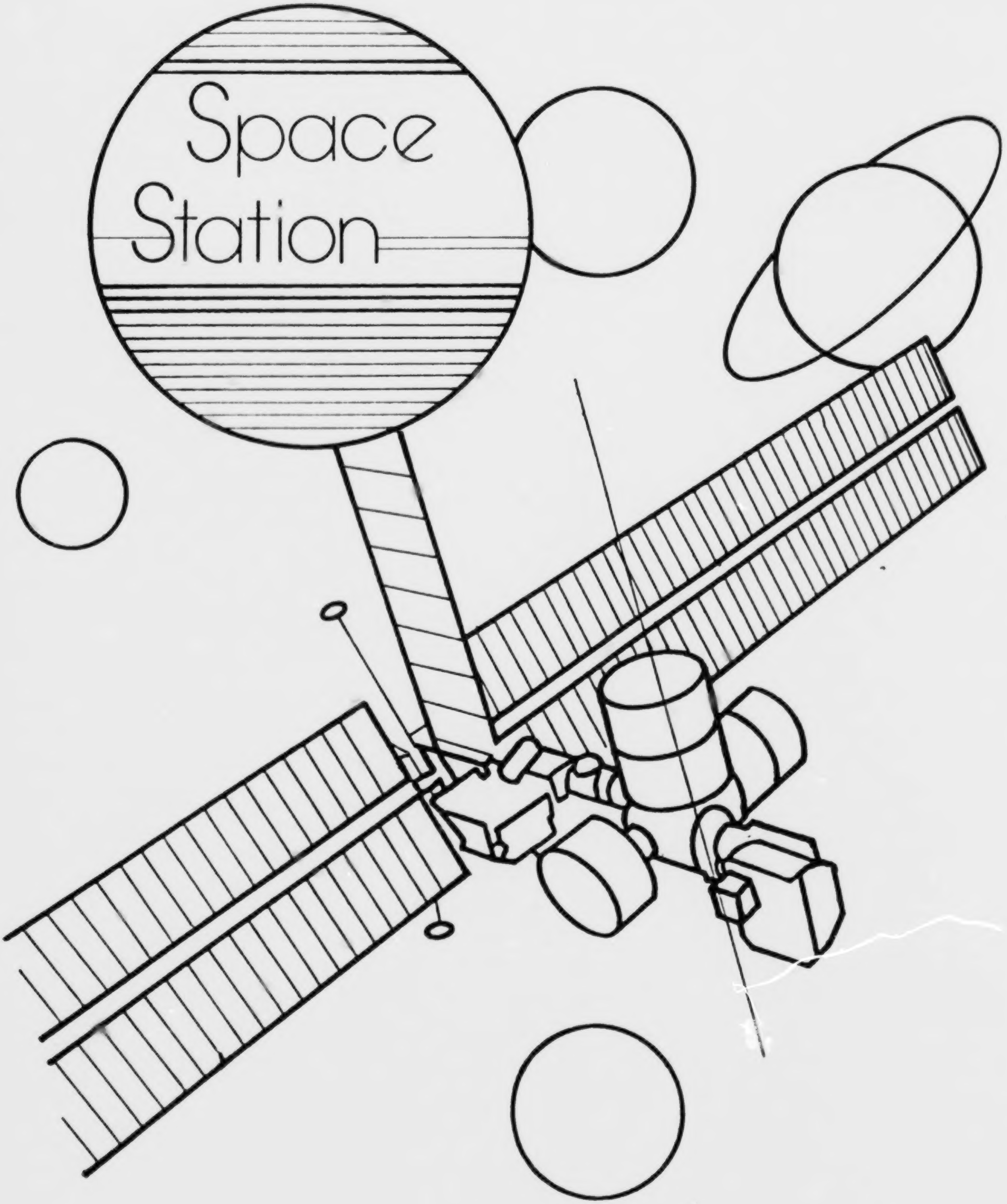
3 bread, flour and cereal

Nutrients in 1 or 2 cups of milk daily can be satisfied by cheeses or ice cream Meat, fish and poultry may be alternated with eggs or cheese, dried peas, beans 3 to 5 cups of fluid daily is recommended.

Help the child learn to group foods into the basic four food groups: Fruit and vegetables, breads and cereals, meat and dairy
Help the child learn to set the table
Help the child learn to follow directions as meals or recipes are followed
Help the child recognize various foods in the grocery store
Help the child learn proper nutritional habits, ie eating basic four foods instead of candy, cokes and junk food



Space Station



NAME: Space Station

SUBJECT/SENSE: Science (Touch)

SKILL: Dramatize being in space

PROCEDURE:

1. With the children, build a spaceship link up and dramatize a trip into space. A large box can be made into a spaceship or shuttle. Cover with butcher paper, paint, cut out windows, etc. The children can be creative in designing their space ship.
   Materials: box, paper, paint, scissors

2. Encourage the children to talk about an imaginary trip into space, stopping at your space station. Encourage the children to use their imagination about what they would see in space.
   Materials: none

3. One of the experiments Christa McAullife, the first teacher selected to go into space, had planned to perform in space was the Carnation (celery) experiment of osmosis. The teacher will put food coloring in a glass of water then put the Carnation in the water. The children will observe the white Carnation turn the color of the food coloring because of osmosis.
   Materials: white Carnation, (celery stalk) food coloring, glass of water

4. Discuss the parts of a Space Station using NASA photographs. (See next page)
   Materials: picture

PARENT/CHILD EXPERIENCE:

Your senses are very different in space. Since there is micro gravity, your body becomes disoriented. Try these activities with your child. Sit in a chair and close your eyes. Place your hands over your knees then open your eyes. Ask, how did you know where to place your hands? (He did not use his eyes or sense of sight or touch.)

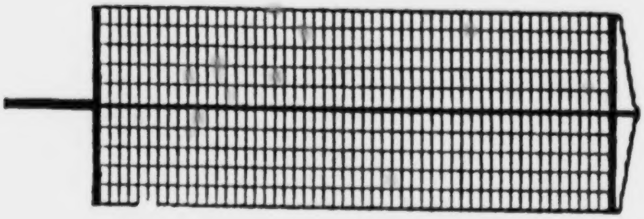
OBJECTIVE: Participate in the activities

BACKGROUND INFORMATION:

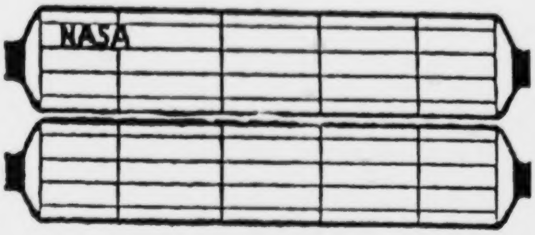
Soon Space Station Freedom will be built in space where the experiments done in the Shuttle can be done all the time, attended by people who could stay in orbit for months at a time. Would you like to live on a Space Station?

DESIGN YOUR OWN SPACE STATION

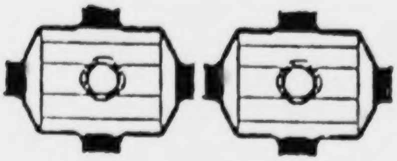
HERE ARE SOME COMPONENT PARTS



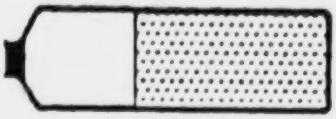
SOLAR PANEL



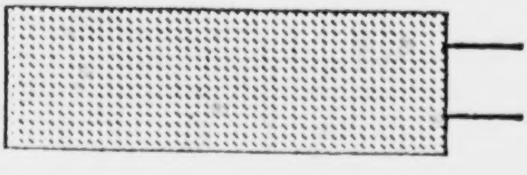
HABITAT MODULE
OR
EXPERIMENT MODULE



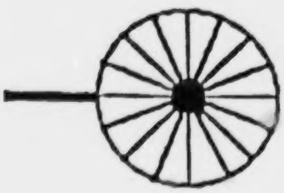
NODES



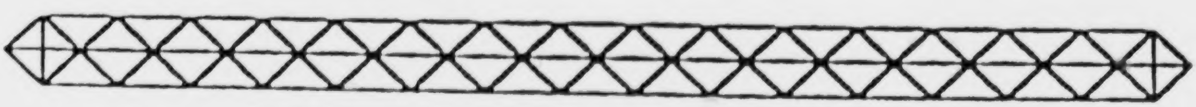
LOGISTICS MODULE
(RESUPPLY MODULE)



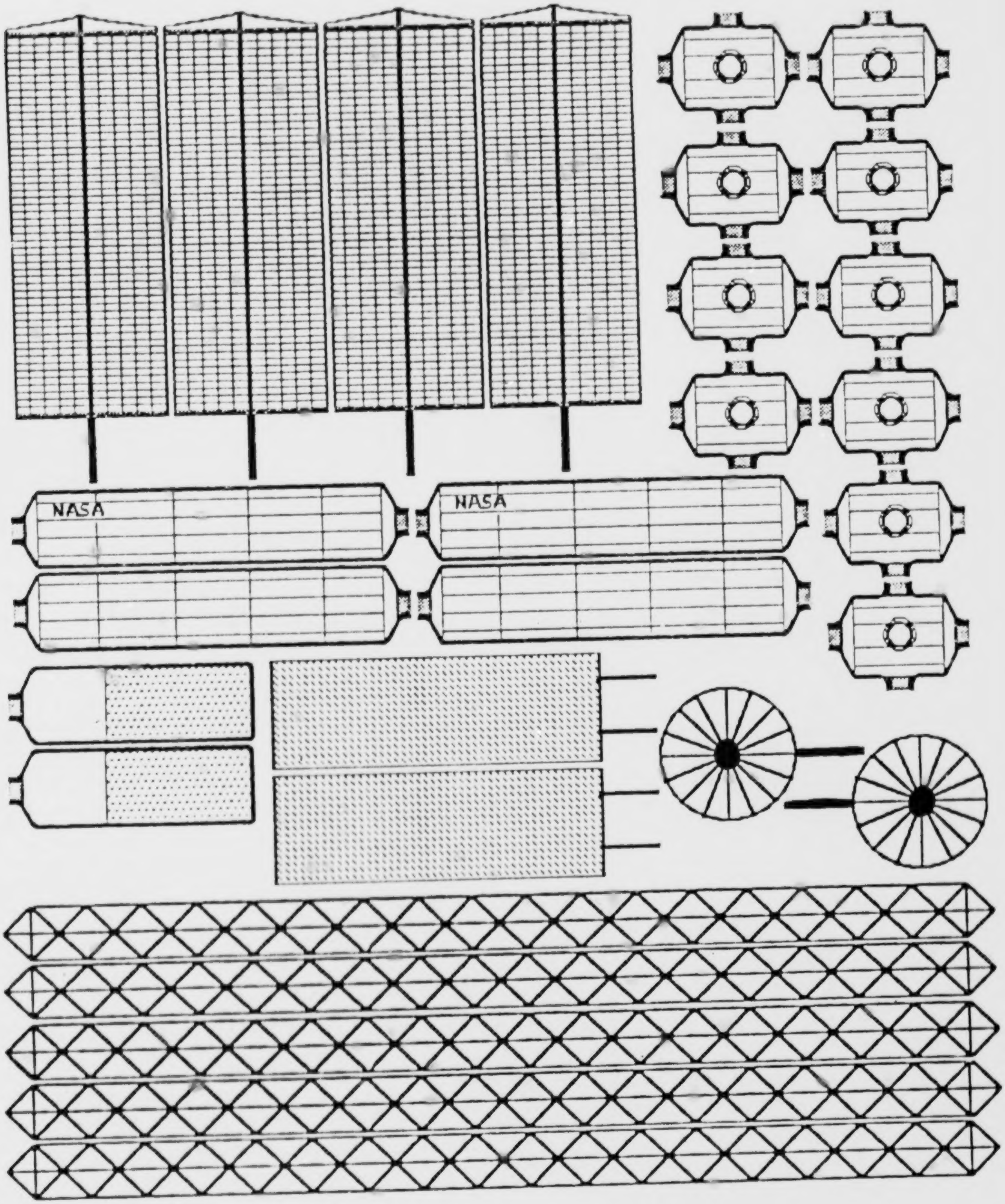
THERMAL RADIATOR



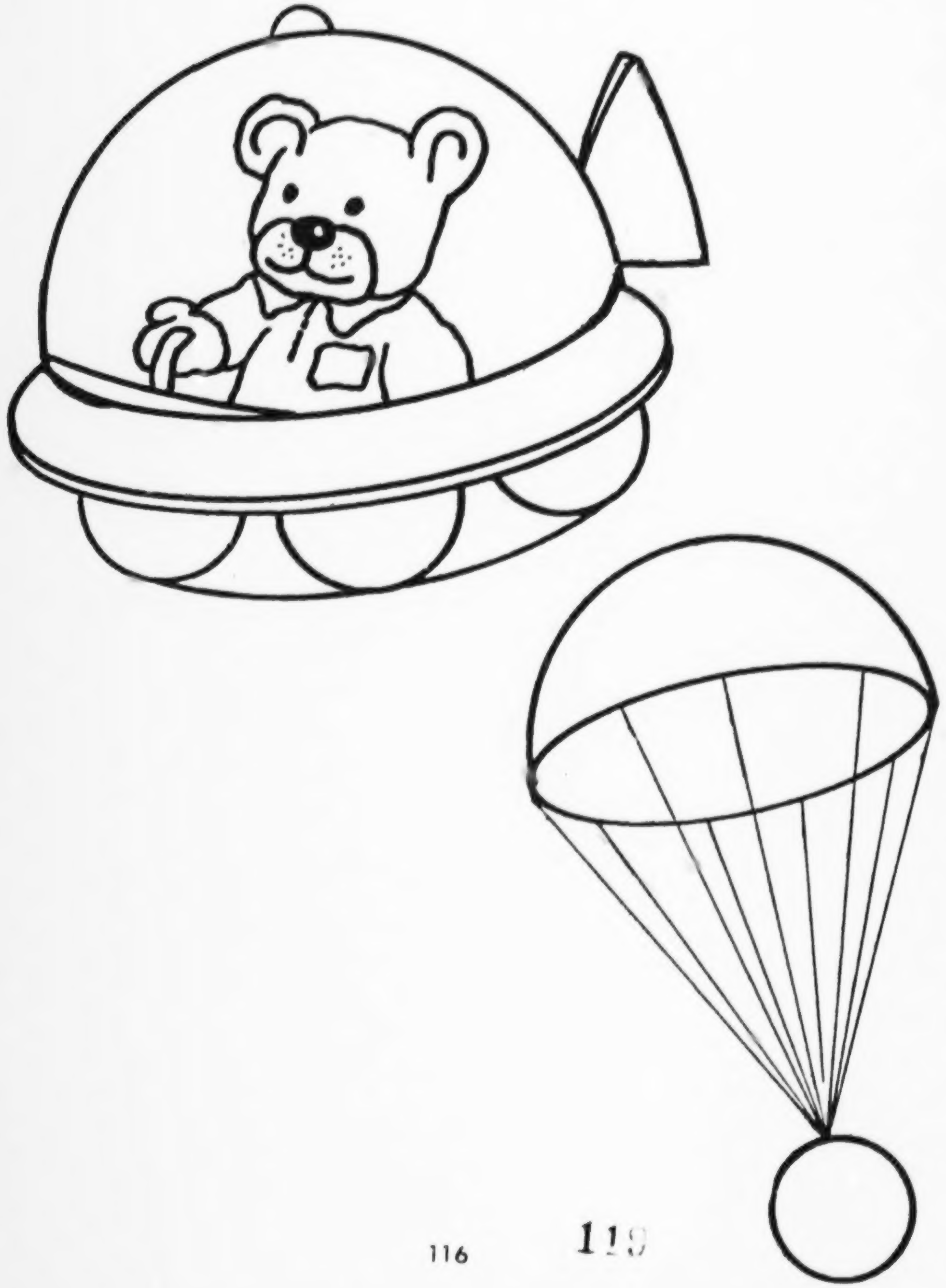
ANTENNA



TRUSS / BEAM


NASA
NASA

SPACE MAIL



NAME: Space Mail

SUBECT/SENSE: Science (Sight, Hearing)

SKILL: Enhance science vocabulary

PROCEDURE:

1. The teacher can make the word family Space Shuttle to increase the initial sound development of the children. Write any word on the Shuttle omitting the beginning letter (sound). As the strip is pulled slowly through the window new words appear. The children can be encouraged to learn word families as new words appear.
   Materials: folder pattern, scissors, markers

2. The teacher can use words to encourage the children to develop language experience stories. Large sheets of paper are given to the children to illustrate their space concepts. The teacher can write their stories on the pictures. The sheets can be taped together and attached to paper coat hanger cardboard tubes. A window can be cut into a box representing a TV screen. The tubes then slipped through the box creating a TV script. Children will look at their TV show over and over.
   Materials: paper, markers, coat hangers, tubes and a box

PARENT/CHILD EXPERIENCE:
Encourage your child to develop his vocabulary using space words over and over.

OBJECTIVE: Use new words.

BACKGROUND INFORMATION:

Word families:

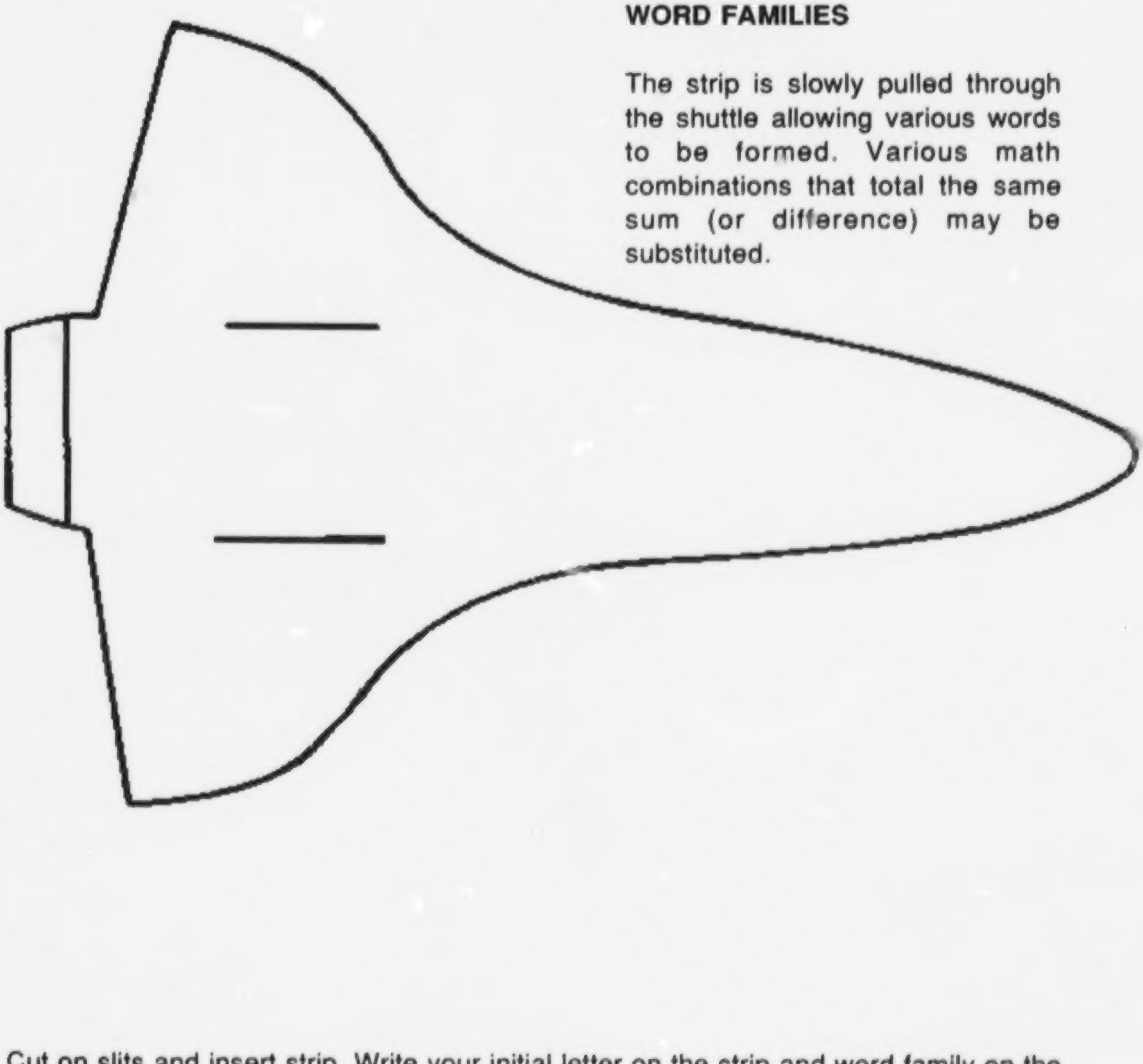
-an	-am	-it	-ill	-et	-ing
man	ham	hit	Bill	bet	sing
can	jam	bit	dill	get	ring
fan	ram	fit	hill	jet	ding
pan	Sam	sit	fill	let	ping
van	dam	pit	sill	met	wing
ran	yam	wit	mill	pet	king

Sample Vocabulary:

ballon
helicopter
glider
jet
rocket
airplane
airline
wings
propeller
snow
rain
hail
water
weatherman
cumulus
cirrus
stratus
rocket
planet
star
space suit
astronaut
blast-off
countdown
lift-off
gravity
thrust
zoom
airport
aviation
airmen
runway
hangar
ticket
fuel
pilot

WORD FAMILIES

The strip is slowly pulled through the shuttle allowing various words to be formed. Various math combinations that total the same sum (or difference) may be substituted.



Cut on slits and insert strip. Write your initial letter on the strip and word family on the shuttle.

BULLETIN BOARDS

NAME: Bulletin Boards

SUBJECT/SENSE: Science, Math (Sight)

SKILL: Reinforcement of concepts presented

PROCEDURE:

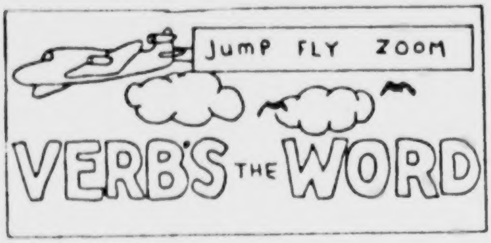
1. The teacher can display the childrens' artwork as she develops bulletin board concepts based on appropriate educational objectives. Various concepts: vocabulary, number concepts, etc. will be reinforced as displayed on the bulletin boards.
   Materials: paper, art supplies (See Suggestions)

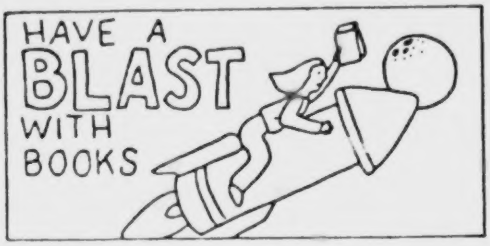
2. As the children draw their space pictures the teacher may use tlhe ideas to develop bulletin boards or additional folder games.
   Materials: paper, drawing instruments

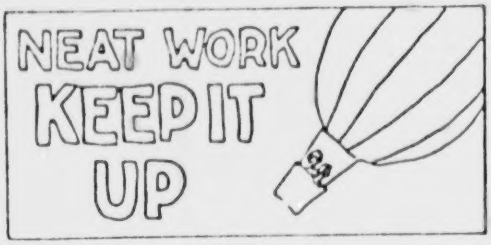
PARENT/CHILD EXPERIENCE:

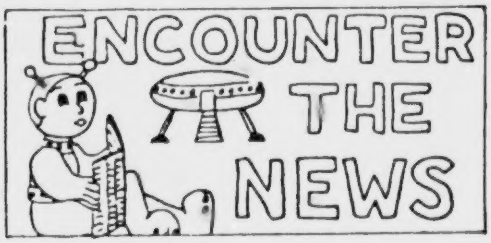
Encourage your child to draw space pictures and add words to the picture as he tells about the picture.
Materials: paper, markers, crayons

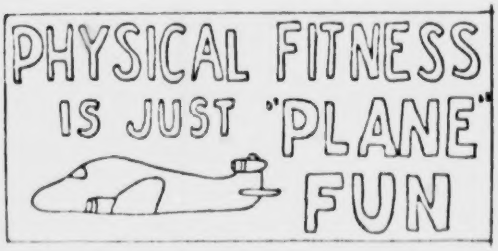
OBJECTIVE: Draw and talk about space pictures

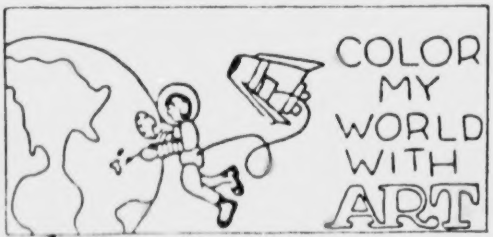

JUMP FLY ZOOM
VERB'S THE WORD


HAVE A
BLAST
WITH
BOOKS

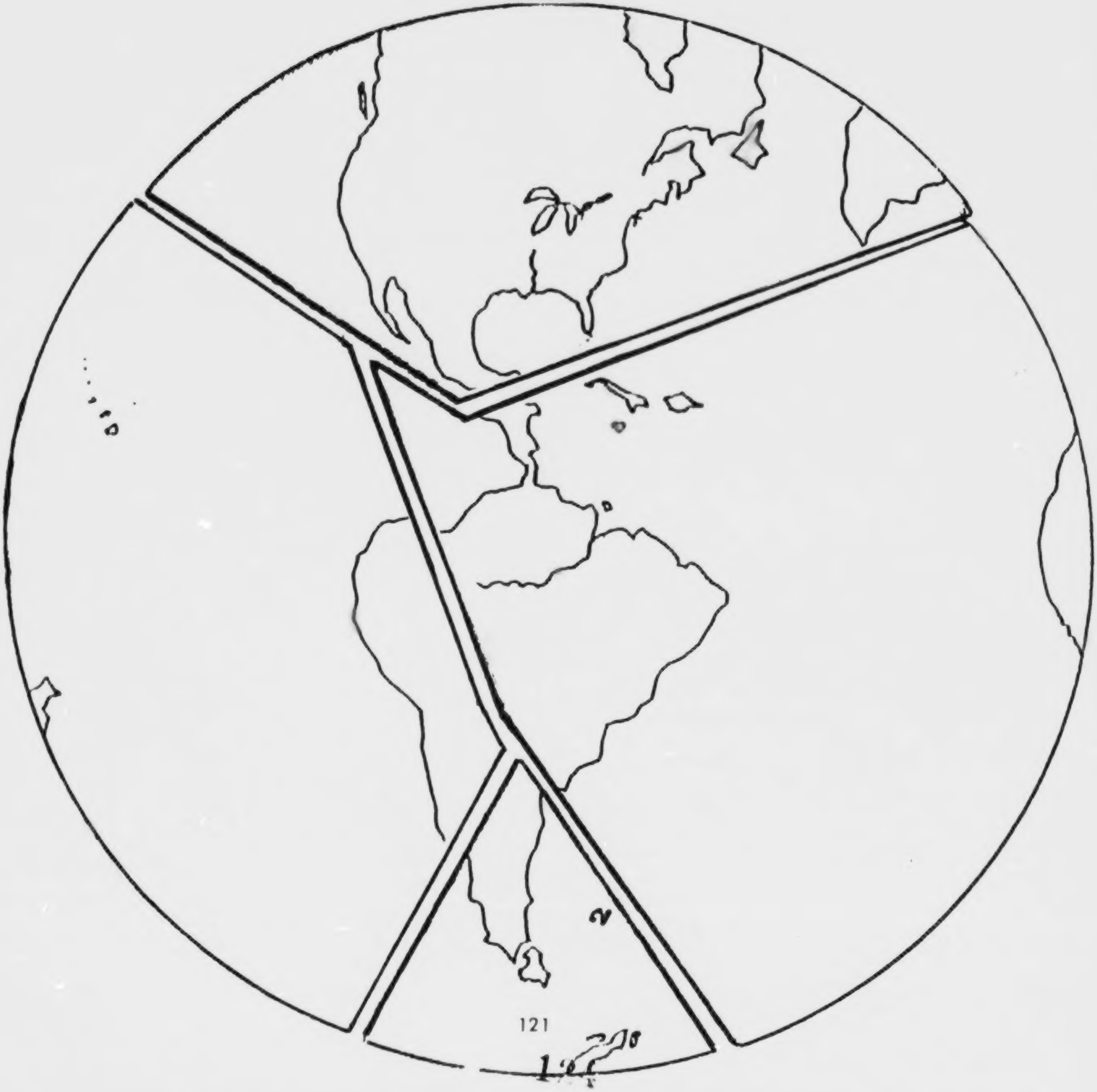

NEAT WORK
KEEP IT
UP


ENCOUNTER
THE
NEWS


PHYSICAL FITNESS
IS JUST "PLANE"
FUN


COLOR
MY
WORLD
WITH
ART

PUZZLES



NAME: Puzzles

SUBJECT/SENSE: Science (Sight)

SKILL: Enhance fine motor development through puzzles

PROCEDURE:

1. The teacher can laminate pictures from the resources received, then cut into puzzle pieces. Then the children can put the puzzle together.
   Materials: Resource pictures, scissors

2. The teacher can use the following symbols to create a matching game. Laminate one set of symbols onto the file folder. Cut out the other set and allow the children to match the symbols. Younger children can match the symbols easier if they are color coded, i.e., color both the rockets red, both balloons blue, etc.
   Materials: Aerospace symbol patterns, colors, scissors

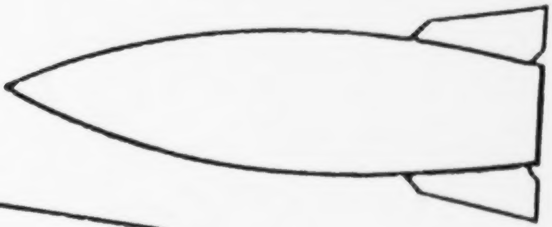
3. The teacher can glue a set of large numerals to a file folder. Cut another set into pieces. Allow the children to match the numeral pieces. Be sure the numerals are color coded for younger children.
   Materials: file folder, numeral patterns

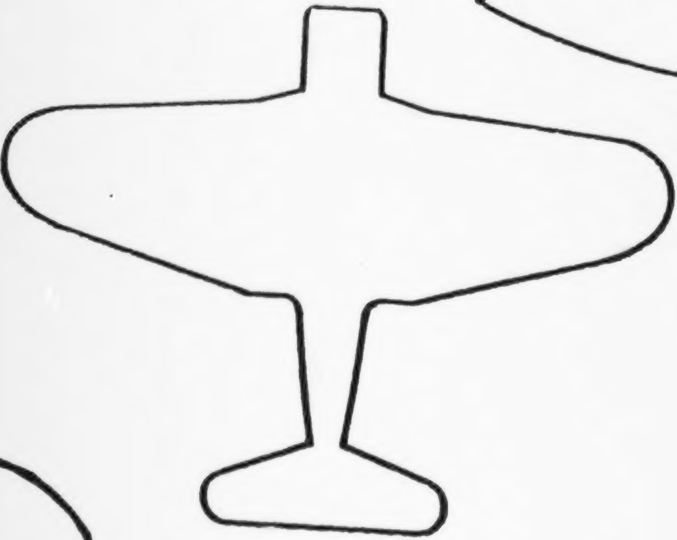
PARENT/CHILD EXPERIENCE:
Make puzzles out of your childs favorite pictures. The cereal box covers can be cut into pieces and make ideal puzzles. Materials: Cereal box covers, scissors

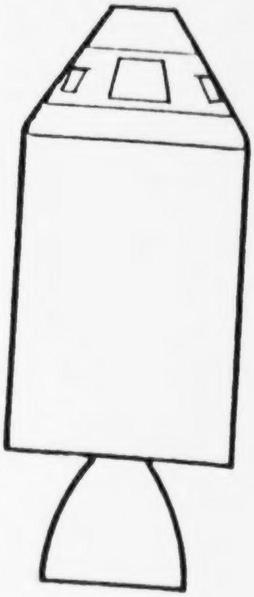
OBJECTIVE: Complete the puzzles

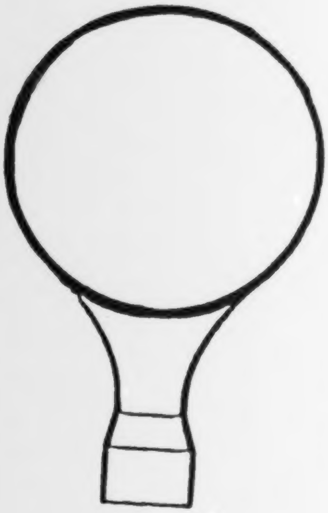
BACKGROUND INFORMATION: Suggestion for puzzle pieces: For three-year-olds: 4 puzzle pieces are suggested; for four-year-olds: 12 pieces; for five-year-olds: more than 12 pieces

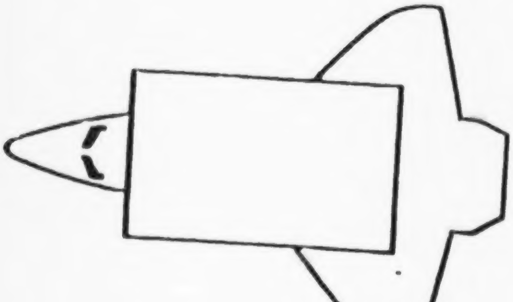
Glue one set of aerospace symbols onto the file folder. Cut out the other set and allow the child to match the symbols. Color matching symbols for younger children and they can match the symbols by color and shape.



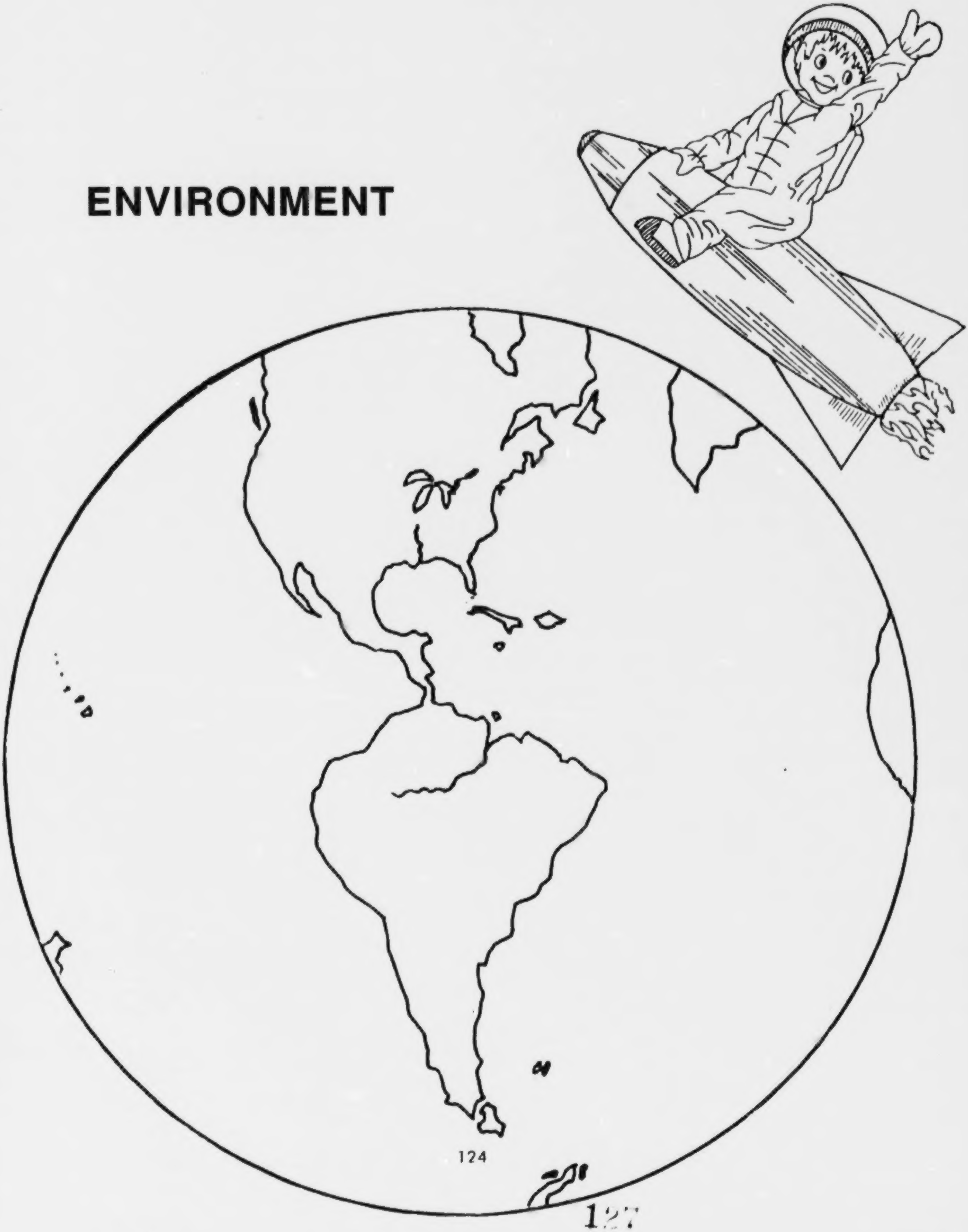








ENVIRONMENT



NAME: ENVIRONMENTAL AWARENESS

SUBJECT/SENSE: Science

SKILL: Become aware of the habitat, including all animals and plants in the environment

PROCEDURE:

1. The teacher will discuss likes and differences of plants and animals. The class can find plants and animals as indicated on the following TASK worksheet.
   Materials: pictures of plants and animals from the immediate environment.

2. Inflate a plastic globe of the earth. Wrap clear saran wrap around the globe. Discuss that the saran wrap represents the atmosphere, a thin layer of gaseous mass surrounding the earth. Stretch the saran wrap indicating thin spots. Discuss that this represents the hole in the ozone layer discovered over the Antarctic.
   Materials: inflatable globe, saran wrap

3. Refer to a Landsat satellite picture of the earth taken from space. Discuss the work NASA is conducting to monitor the earth's environment from space.
   Materials: Landsat satellite pictures available from NASA

4. Discuss a simple food chain referring to the handout on the fish. Then encourage the students to place the turtle life cycle and fish food chain in sequencial order.
   Materials: worksheets

PARENT/CHILD EXPERIENCE:

During a meal, discuss with your child the necessity for food for survival. Discuss where the food on the table originates: plants, or animals. Ask your child what he must depend upon for survival.

Objective: Awareness of a simple food chain.

BACKGROUND INFORMATION:

The astronauts have been very concerned about the changing condition of the earth, as they view it from the Space Shuttle Orbiter. They have launched satellites for NASA, such as the Upper Atmospheric Research Satellite, Landsat satellites, and others to study "Mission to Planet Earth", the effects of man on the environment. NASA will monitor and measure changes in the atmosphere and environment, especially in such areas of concern as the Amazon Rain Forest, the Kuwaiti oil fields and the Pacific Northwest Rain Forests. As a result of this effort, NASA can help predict changes and influence decision makers to take steps to reduce the impact of man's effect on altering the environment.

TITLE: Looking for the Difference

TASK 1:
Find an animal with 6 legs

TASK 2:
Find an animal with 4 legs

TASK 3:
Find an animal with 2 legs

TASK 4:
Find a plant with 3 colors

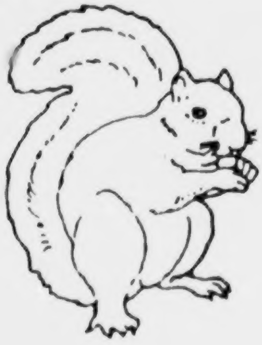
TASK 5:
Find a plant with just 1 color

TASK 6:
Find a plant with smooth bark

TASK 7:
Find a plant with rough bark

TASK 8:
Find a plant that shows an insect was eating it

TASK 9:
Find two plants with different smells



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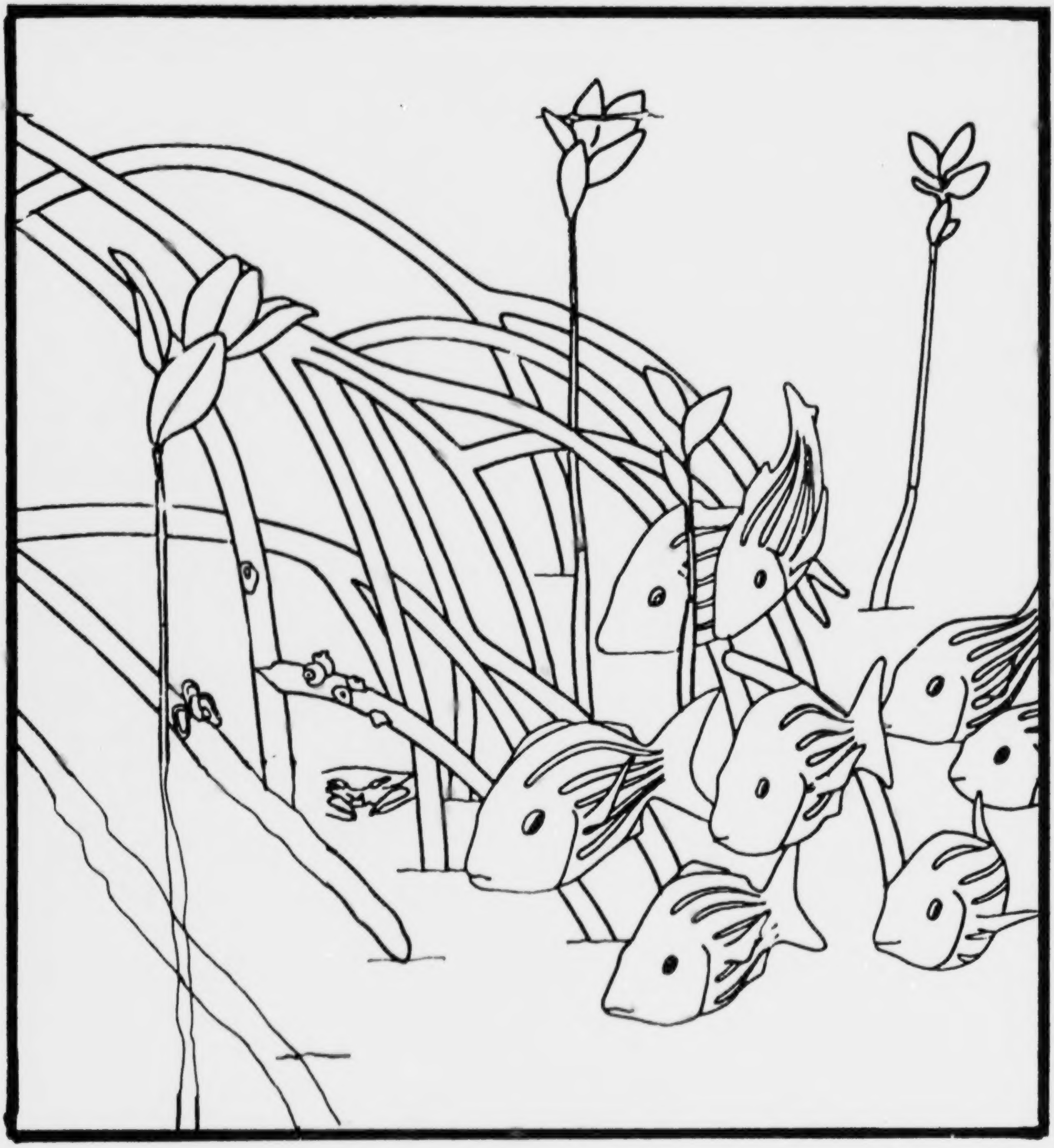

Underwater areas provide food for land and water animals. For example, man eats fish, fish eat shrimp and shrimp eat detritus (decaying plants). This is one example of a simple food chain. All living things in nature depend upon each other for survival.

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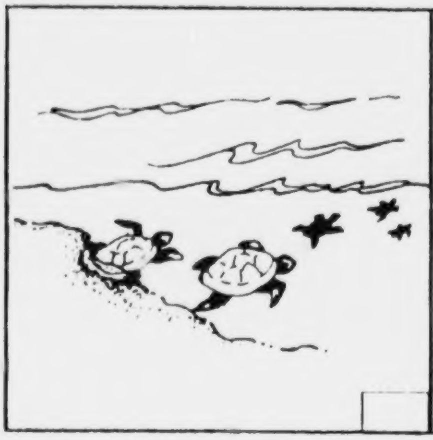
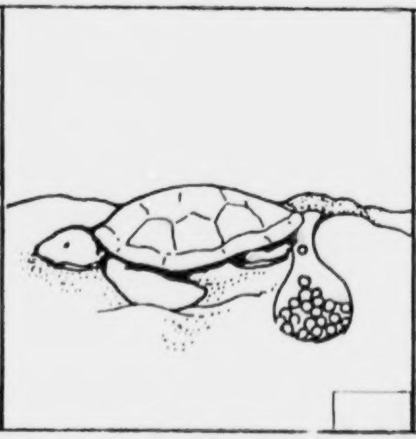
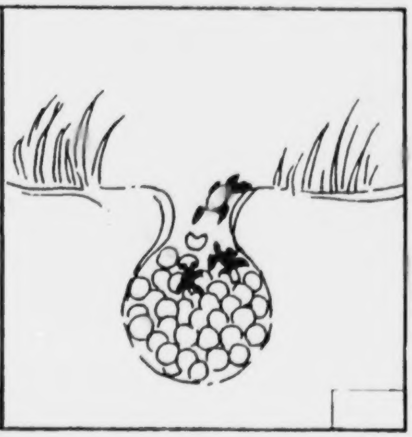
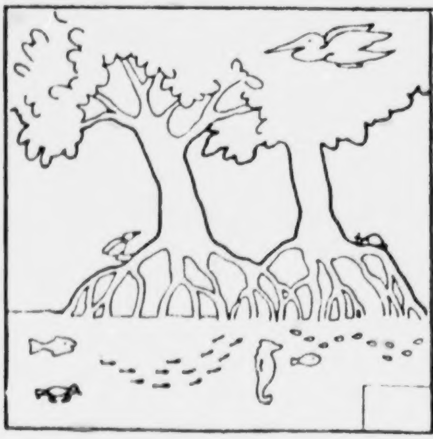
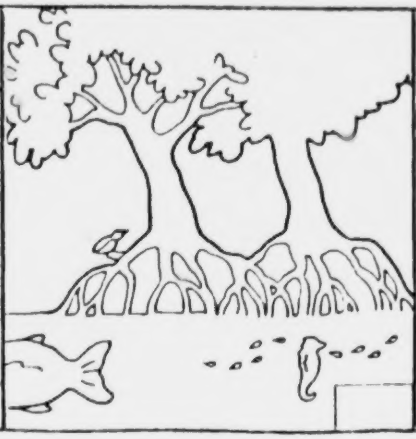
ARRANGE THE PICTURES IN SEQUENTIAL ORDER

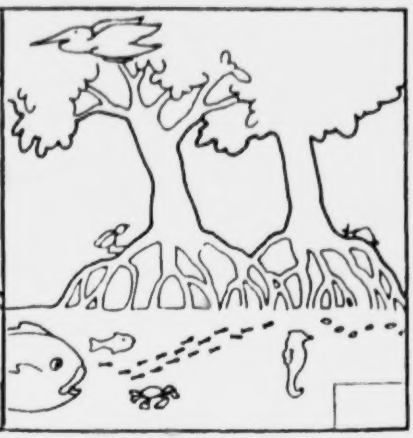












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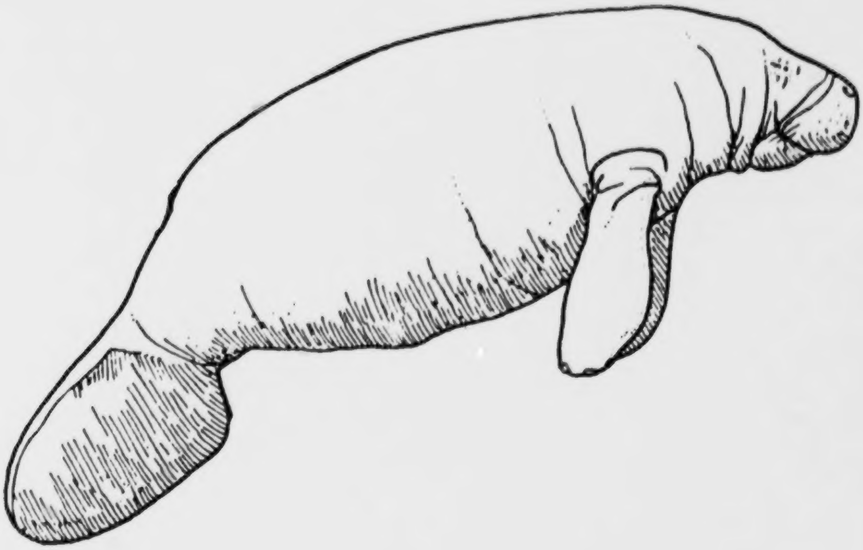
ENDANGERED SPECIES



NAME: Endangered Species

SUBJECT/SENSE: Science

SKILL: Become aware of the endangered species in your local environment

PROCEDURE:

1. The student will discuss the term "endangered species", which means there is a danger of the species becoming extinct. Refer to the picture of the manatee as an example of an endangered species.
   Materials: worksheet on endangered species-manatee picture

2. Discuss the habitat of the alligator, referring to the worksheet on the alligator's habitat and discussing the questions with the students.
   Materials: worksheet on the alligator

3. On the next school field trip discuss the Florida Save the Manatee license plates. Encourage the students to watch for the license plates and place the number in the correct column. The students may vary the activity by counting the license plates on the way to and from school. They may place the number on the chart on the following worksheet.
   Materials: License Plate Chart worksheet

4. The American Bald Eagle, our national bird, is also an endagered species. Find pictures of the eagle (ie. on a quarter, dollar bill) then draw the eagle.
   Materials: American Bald Eagle pictures

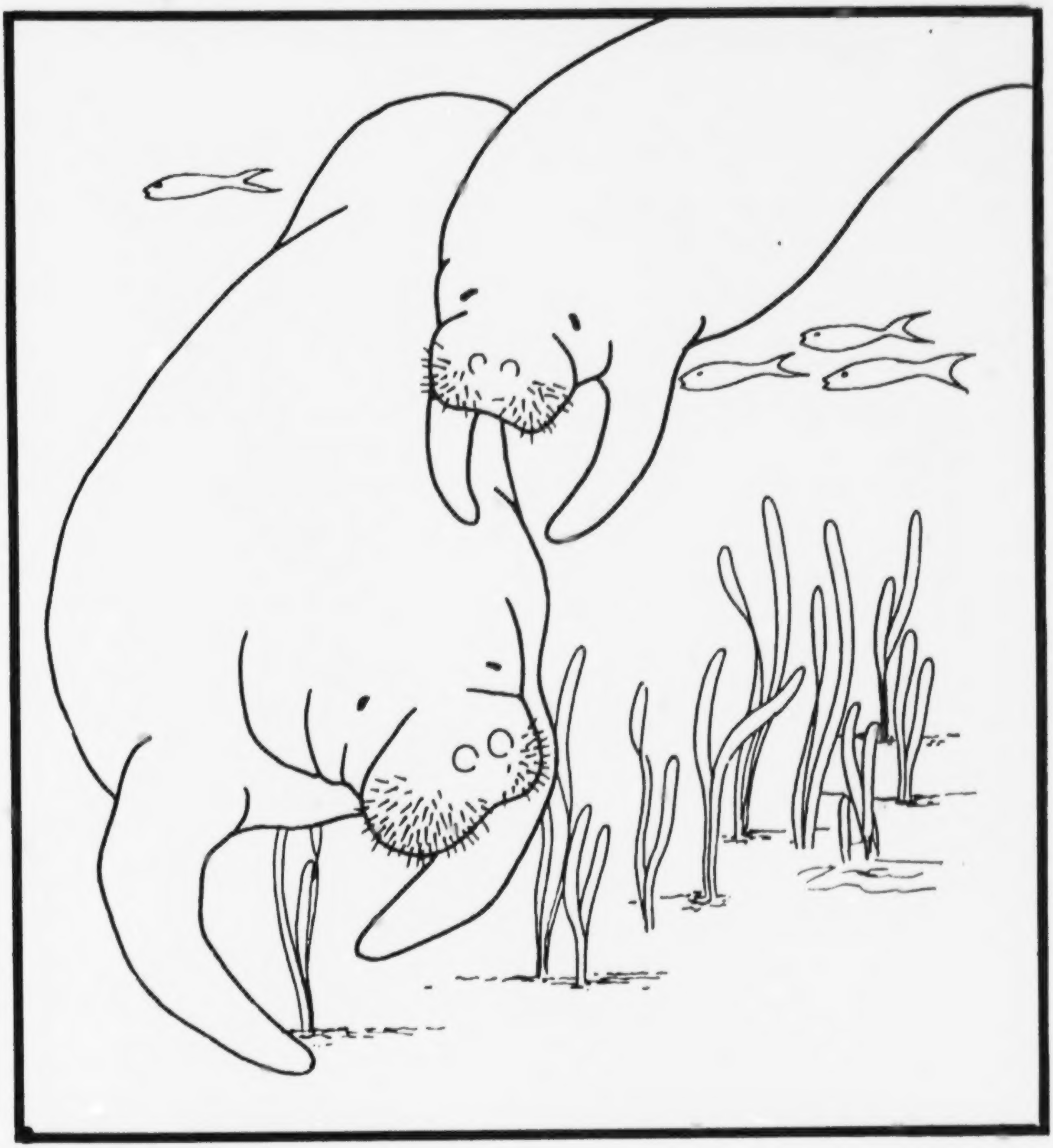
PARENT/CHILD EXPERIENCE:

Take your child to a pet store and discuss the care of the various pets in the store. If possible, purchase a pet for your child to care for.

OBJECTIVE: Care of animals

BACKGROUND INFORMATION:

NASA, Kennedy Space Center, is part of the National Wildlife Refuge of Merritt Island and the Canaveral National Seashore. Over 300 endangered species, more than any other location, live on the protected Kennedy Space Center. There is a great concern by NASA officials to protect the plants and animals as they build new constructions and launch spacecraft.



ENDANGERED SPECIES are plants or animals which exist in very few numbers today. The best way to save endangered species is to protect the areas where they live. For example, manatees eat plants in shallow water. Can you think of a way a boater can protect the manatee?

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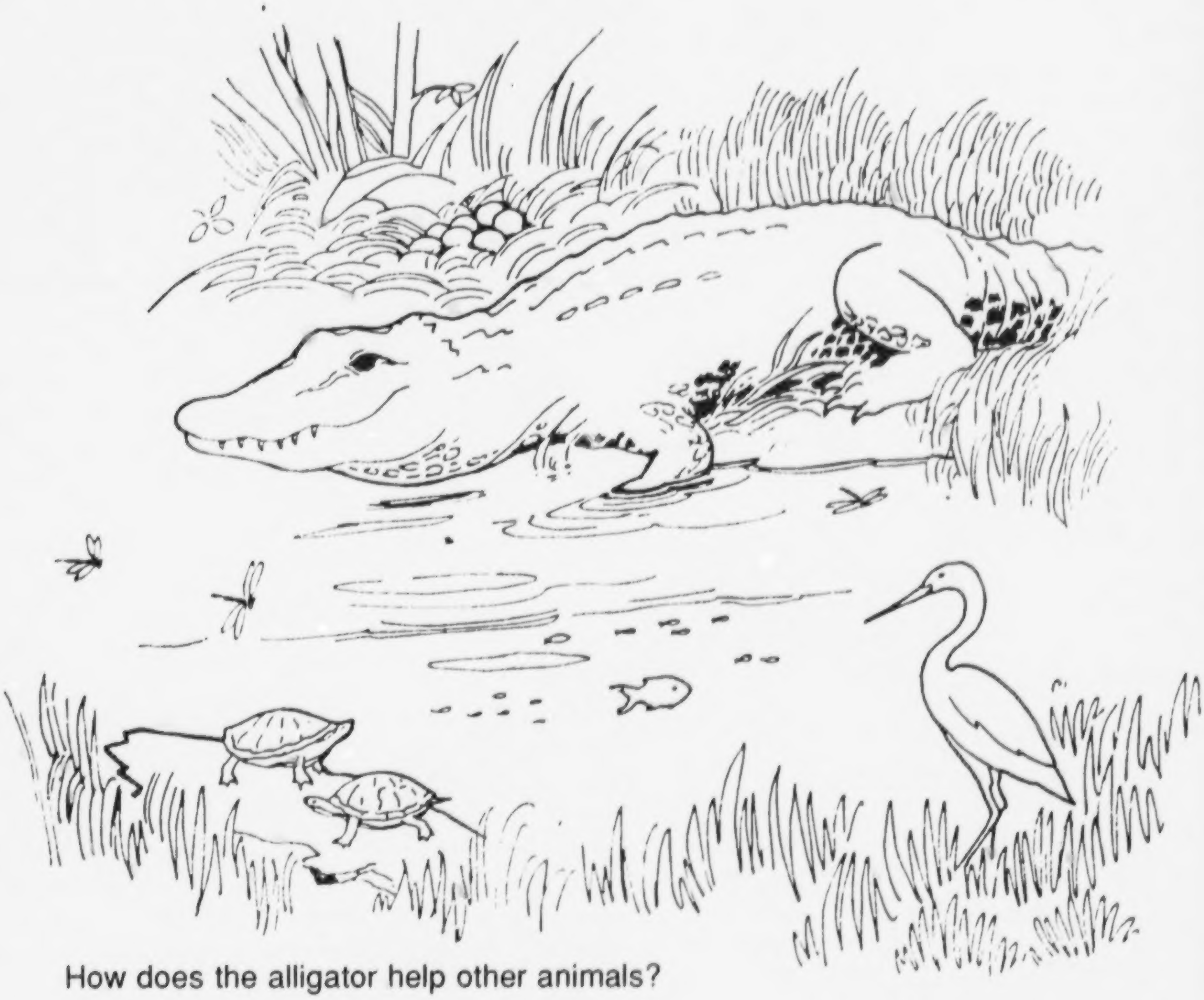
TITLE: The Alligator's Habitat

This picture shows a mother alligator.
She made a nest of grass.
The nest has alligator eggs.
Other animals live where the alligator lives.
Look at the picture and find the other animals.



How does the alligator help other animals?

How do other animals help the alligator?

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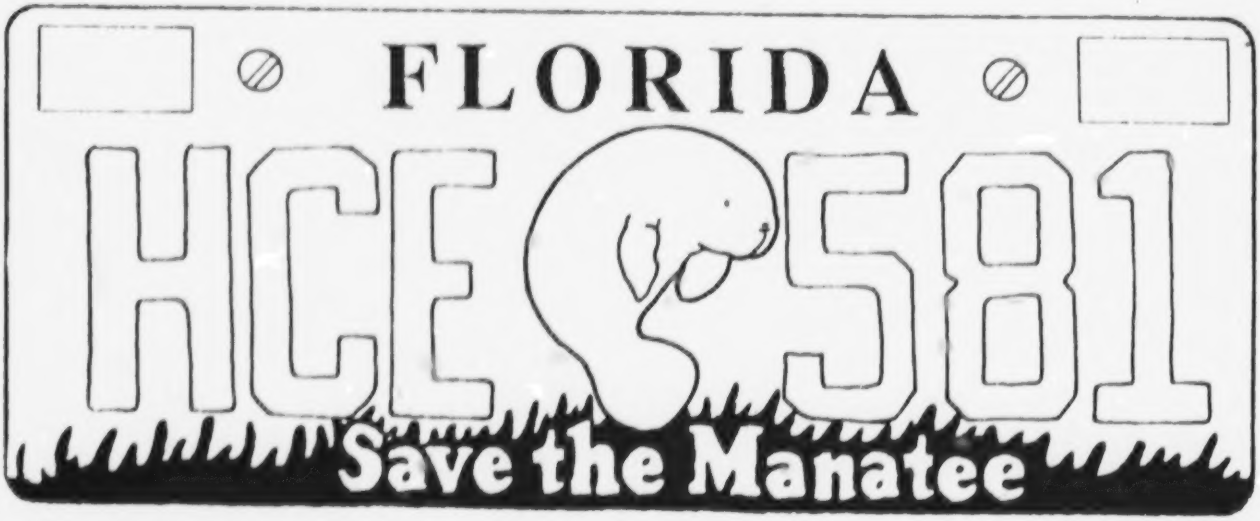
COUNT HOW MANY FLORIDA LICENSE PLATES YOU CAN IDENTIFY WITH THE FLORIDA MANATEE.

How Many?

	Monday	Tuesday	Wednesday	Thursday	Friday	Total
Florida Manatee						


FLORIDA
HCE 581
Save the Manatee

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PARENT/CHILD EXPERIENCE

Duplicate the following parent activity pages. (Make enough copies for each parent). Cut out each activity and send home with the children as you present the concept in class. (Remember, you may choose to present one or more of the activities or none, depending on your interests and the level of your children.)

NAME: Clouds

PARENT/CHILD EXPERIENCE:

Go outside and look at the clouds with your child. Ask your child what he thinks the clouds mean. If some clouds look darker than others ask your child if he knows why some clouds look darker than others. If there is a dark or thicker cloud (it is more dense allowing less sunlight to pass through) it probably means it is going to rain because it has more moisture in it. Ask your child to talk about how the rain sounds.

OBJECTIVE: Observe various clouds

NAME: Weather

PARENT/CHILD EXPERIENCE:

Hot air expands. This can be demonstrated by the following experiment. Blow up a balloon. Tie it with a string. Tie it to a hot radiator or near a sunny window. When the balloon gets hot, it bursts because hot air expands. Ask your child to tell what happened. Materials: Balloon, string

OBJECTIVE: Observe hot air expanding

NAME: Constellations

PARENT/CHILD EXPERIENCE:

Go outside and observe the constellations with your child on a clear night. See if you can locate the Big Dipper.

OBJECTIVE: Observe stars in the sky

NAME: Solar System

PARENT/CHILD EXPERIENCE:

Go outside with your child at different times during the day. Watch the effects of the sun casting a shadow at different times of the day. This will show your child how the sun changes the amount of heat and light provided during the day.

OBJECTIVE: Show that the sun gives us heat and light as it shines on earth.

NAME: Kites

PARENT/CHILD EXPERIENCE:

1. The parent will read the safety rules of kite flying to their child.

2. Build and fly a kite with your child.

Be sure to attach a tail to the kite. It keeps the bottom of the kite down providing stability. If you don't have a tail, the kite spins. The length of the tail can be adjusted to provide the stability needed.

OBJECTIVE: Fly a kite seeing the effects of air

NAME: Balloons

PARENT/CHILD EXPERIENCE:

1. Have your child blow on a dandelion (spring or fall). Have your child watch the flight of the dandelion and compare it to balloons and birds in flight.
   Materials: dandelion, balloon

2. Help your child fill one balloon with air and another with water and tie the balloons. Have your child take the two ballons outside and drop them at the same time to compare which is heavier; lighter. Explain the concept of gravity to your child--heavier objects fall faster on earth because of air resistance.

OBJECTIVE: See the effects of air and gravity

NAME: Parachute

PARENT/CHILD EXPERIENCE:

Find different scraps of cloth at home. With your child make parachutes out of different materials and add different weights. Have your child compare the difference as the parachutes fall. (The cloth will be too heavy unless a heavy weight is used.) Materials: Klennex, scraps of cloth, string, weights

OBJECTIVE: Be able to drop the parachute seeing the effects of air on a falling object

NAME: Flight

PARENT/CHILD EXPERIENCE:

Help your child draw an airplane, noting the front (that thrust makes it move forward) and top (that lift makes it go upward). Talk about how a plane flys. (An airplane flies because air lifts it up, gravity pulls it down and the propeller and engine pull it forward.) Materials: Paper, crayons

OBJECTIVE: Draw an airplane

NAME: Pilots

PARENT/CHILD EXPERIENCE:

1. Try to visit a local airport with your child. If a pilot is available he may show you the parts of an airplane. Your child can compare the different airplanes at the airport.

2. After the airplane lands it may go to an airport garage called a hangar. The child can make airplane hangars out of boxes and count small model airplanes as they enter into their hangars. If boxes and model airplanes are not available the folder game pattern can be used to create this game. Numeration to ten will be enhanced. Materials: Boxes, model airplanes or folder game patterns, scissors, markers

OBJECTIVE: Visit an airport; place airplanes in hangars

NAME: Airport jobs

PARENT/CHILD EXPERIENCE:

Encourage your child to tell about an imaginary airplane trip. Encourage him to tell about where he is going, what he would find, and why he wants to go there.

OBJECTIVE: an airplane trip

NAME: Aerospace Pioneers

PARENT/CHILD EXPERIENCE:

Talk to your child about aviation when you were his age. How did you travel compared to how people travel today?

EXPECTED OUTCOME: Listen and answer questions

NAME: Rockets

PARENT/CHILD EXPERIENCE: The parent will blow up a balloon to demonstrate that a rocket needs thrust to blast-off. As your child lets a balloon go the air is released from it causing it to move forward. Materials: Balloon

OBJECTIVE: Listen to the rocket balloon

NAME: Rocket

PARENT/CHILD EXPERIENCE: Help your child made a rocket out of a cardboard cylinder (see next page for directions). Materials: Cardboard cylinder, paper, scissors, glue or tape

OBJECTIVE: Create a rocket

NAME: Collage

PARENT/CHILD EXPERIENCE: The parent will help your child cut out magazine pictures or draw pictures of things that fly. Using a variety of media (colors, paint, drawings, pictures, etc.) encourage your child to make the collage as creative as possible. The child's concept of things that fly will be enhanced. Materials: Magazine, paper, scissors, markers, available drawing tools

OBJECTIVE: Crate a collage

NAME: Trip to the Moon; Blast-Off

PARENT/CHILD EXPERIENCE:
Parents can observe the moon phases at night with their child. Talk about how the moon changes shapes. Encourage your child to draw these shapes.

OBJECTIVE: Observe the moon

NAME: Astronauts

PARENT/CHILD EXPERIENCE: With your child make a moon landscape. Place small objects on a piece of cardboard or other hard surface. Cover with tin foil. This will create a surface of craters and mountains. Purchase 10 small toy astronauts, space ships, etc. and encourage your child to act out the moon landings. Materials: Tin foil, cardboard, small objects, toy astronauts

OBJECTIVE: Create a surface representing craters and mountains

NAME: Space Sensations

PARENT/CHILD EXPERIENCE:
The astronauts see a sunrise and sunset every 45 minutes as they orbit the earth. An astronaut day is the same as a day on earth--there is still 24 hours in a day, however, we see the sunrise and sunset at different times. With your child, watch the sunrise and sunset. The child will learn the day (sun) and night (dark) concept.

OBJECTIVE: Observe a sunset and/or sunrise

NAME: Space Shuttle

PARENT/CHILD EXPERIENCE:
The parent can set up a tent at home and let your child participate in various activities-- eating, paper work (coloring, etc.), playing, etc. Your child will learn about living in a confined space. Compare this to living in a confined space. Compare this to living and working in Space Shuttle. Materials: Bed sheet

OBJECTIVE: Create a tent and become aware of limited space

NAME: Space Suits

PARENT/CHILD EXPERIENCE:
Talk with your child about how layers of clothing insulate the body to keep you warm. The astronauts traveling on the moon needed insulation because there was no atmosphere and they needed to keep their body temperature constant so they would not die. (They also needed an air supply since there was no oxygen to breath.) Let your child dress up as an astronaut, encouraging him to use his imagaination.

OBJECTIVE: Dress up as an astronaut for dramatic play

NAME: Space Food

PARENT/CHILD EXPERIENCE:
Have your child help prepare balanced meals at home using dehydrated baby food. Talk about the 4 basic food groups. (See parent note)
Materials: Dehydrated baby food (Hines or Gerber)

OBJECTIVE: Prepare then compare taste, smell, texture of food

NAME: Space Station

PARENT/CHILD EXPERIENCE:

Your senses are very different in space. Since there is micro gravity, your body becomes disoriented. Try these activities with your child. a. Sit in a chair and close your eyes. Place your hands over your knees then open your eyes. Ask, how did you know where to place your hands? (He did not use his eyes or sense of sight or touch.) b. Close your eyes again. Put your fingers in your ears; Again, question your child to see how he knew where his ears were.

OBJECTIVE: Participate in the activities

NAME: Space Mail

PARENT/CHILD EXPERIENCE:

Encourage your child to develop his vocabulary using space words over and over.

OBJECTIVE: Use new words

NAME: Bulletin Boards

PARENT/CHILD EXPERIENCE:

Encourage your child to draw space pictures and add words to the picture as he tells about the picture.

Materials: paper, markers, crayons

OBJECTIVE: Draw and talk about space pictures

NAME: Puzzles

PARENT/CHILD EXPERIENCE:

Make puzzles out of your childs favorite pictures. The cereal box covers can be cut into pieces and make ideal puzzles.

Materials: Cereal box covers, scissors

OBJECTIVE: Complete the puzzles

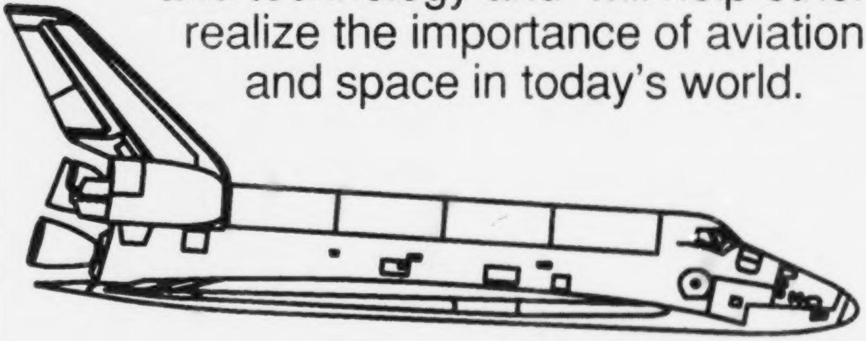
AVIATION AND SPACE

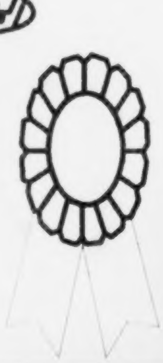
Certificate of Completion

____

NAME

I have learned more about aviation and space through mathematics, science, language arts, the humanities and technology and will help others realize the importance of aviation and space in today's world.





EDUCATION AND AWARENESS
BRANCH, PUBLIC AFFAIRS
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FLORIDA

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NASA John C. Stennis Space Center
Teacher Resource Center
Building 1200
Stennis Space Center, MS 39529
(601) 688-3338

Mississippi

ANNOTATED BIBLIOGRAPHY ON CHILDREN'S BOOKS RELATING TO AVIATION AND SPACE

Franklin M. Branley. New York: Thomas Y. Crowell Co. Series of children's books on all aerospace topics with simple text, delightfully illustrated:
The Big Dipper
A Book of Outer Space
A Book of Planets (Describes each of the nine planets)
A Book of Satellites
A Book of Flying Saucers for You/Discusses sightings of flying saucers or UFOs with possible explanations
Eclipse: Dark in Daytime
Gravity is a Mystery
Is There Life in Outer Space?
Journey into a Black Hole
The Moon Seems to Change (New York: Harper and Row 1987) (The phases of the moon are described)
The Moon-Jack and Jill and Other Legends (Lexington MA: Ginn and Co 1972) (Legends of the moon and the phases are explained.)
North South East and West (Beginners learn to tell directions to locate directions with gravity map reading and compass reading activities)
The Planets in Our Solar System (Introduction of the solar system with directions for making models of the relative sizes and distances)
Rockets and Satellites (Explains a rocket and satellite functions)
Saturn (Describes the 6th planet from the sun its rings and moons with photographs)
The Sky is Full of Stars
The Sun-Our Nearest Sun (Explains the sun is a star with examples of how large and hot the sun is)
Sunshine Makes the Seasons
Weight and Weightlessness
What Makes Day and Night
What the Moon is Like (Description of sights and experiences on the moon based on information gathered from astronauts)

A Day in Space. Suzanne Lord and Jolie Epstein. New York: Scholastic Books, Inc., 1986. (A factual book detailing an astronaut's training and a space flight using actual NASA photographs. All aspects of the flight are covered-eating, sleeping, working and playing with the toys in space)

Airplanes, Spaceships and Balloons. Sue Swallow. New York: MacDonald and Co., 1974. (Simple encyclopedia for very young readers including pages on planes, gliding, airships and the moon.)

Amelia's Flying Machine. Barbara Shook Hazen. New York: Doubleday and Co., 1977. (A young girl spends the summer with her grandmother and cousins. They have many adventures, one of which was building a flying machine.)

All About the Stars. Anne Terry White. New York: Random House, 1954. (The stars as seen and understood by scientists)

Anansi, The Spider. Gerald McDermott. New York: Holt, Rinehart and Winston, 1972. (In trying to determine which of his six sons to reward for saving his life, Anansi, the spider, is responsible for placing the moon in the sky.)

The Ant and the Astronaut. A. Mityayev. Moscow Progress Publishers, 1973. (This is a story about an ant who is the only member of his colony to have the honor of talking with an astronaut. The other stories in the book discuss gravity, night and day, a meteor shower and the atmosphere.)

Angry Moon. Sleator Johnson. Boston: Little,1970. (Northwest Coast Native American story about the angry moon man being outwitted by a magic spell and devotion of a small boy.)

Around the World in Ninety Minutes:TheJourney of Two Astronauts. Rocco V.Feravoio. New York Lothrop, Lee & Shepard,Co,Inc., 1968. (The author takes the reader from the landing pad, through a journey and back to earth.)

Astronauts. Carol Green. Chicago: Children's Press, 1984. (The discussion of space travel from the beginning to the present. Training and duties of the astronauts are discussed.)

The Astronauts. Dinah L. Moche. New York: Random House, 1978. (Actual photos depict the astronauts jobs and their space ships.)

Astronaut Critter. Mercer Mayer. New York: little, Simon, 1986. (Astronaut Critter makes a space ship to take him into space. He takes pictures, eats a snack, looks at the moon and more. During the story, you realize Space Critter is still on the ground using his imagination.)

Beyond the Milky Way. Cecile Schoberle. New York: Crown, 1986. (Looking out a city window and seeing the night sky between the buildings, a child describes the glowing wonder of outer space and imagines another child doing the same on a distant planet.)

Book of Greek Myths. Ingri and Edgar Parin d'Aulaire. Garden City, New York: Doubleday, 1962. (The Greek myth describing Helios, the sun, as a flaming charioteer who speeds his fiery steeds across the sky and Seiene, the moon, his quiet sister who drives her white horses nightly across the sky.)

Cabbage Moon. Jan Wahl. New York: Holt, Rinehart and Winston, 1965. (Princess Adelgitha travels on stilts and her little dog, Jennie, believe the smiling moon to be a cabbage. One day Lorenzo steals it to mix his salad. Jennie and the Princess rescue it.)

The Challenge of Space. Robin Kerrod.Minneapolis: Lerner Publications Co., 1980. (A question and answer book about rockets, satellites and space travel.)

Come to Work with Us in Aerospace. Jean Wilkinson and Ned Wilkinson. Milwaukee, Wisconsin: Sextant Systems, 1970. (Children take adult jobs, all of which deal with the aerospace industry. Each page describes a job.)

Comets. Kate Petty. New York:Franklin Watts, 1985. (Non-fiction book explains what comets are and what they look like. Includes information about comets and meteorites seen in the past, such as Halley's Comet. Questions and answers in the back of the book.)

Comets, Asteroids and Meteors. Dennis B. Fradin. Chicago: Children's Press, 1984. (Non-fiction book that discusses the solar system, comets, asteroids and meteors. Includes vivid color photographs. Also contains a list of some famous comets, the largest asteroids and some yearly meteor showers.)

The Double Planet. Isaac Asimov. London: Abelard-Schuman, 1960. (Scientific study of the earth and moon. Many facts and charts are provided.)

Easy to Make Spaceships That Really Fly. Mary Blocksma and Dewey Blocksma. New Jersey: Englewood Cliffs, 1983. (Displays the different patterns of spaceships that children can make and what materials are needed.)

Emily Emerson Moon. Jean Merflll. and Ronnie Solbert. Boston: Little, Brown and Co.,1983.(A rhymed story about a little girl and her father who gets her a sun (a sunflower), a rainbow (a ribbon) and the moon (a reflection in the goldfish pool.)

Far Out How to Create Your Own Star World. Robin West. Minneapolis, Minnesota First Avenue Editions, a division of Lerner Publications Co., 1987. (Kids can create their own star world by using a few easily found household items. Projects such as Astro Shuttle, Interplanetary Rover, Meteor Man and Cosmic Centipede are described.)

Flying. Donald Crews. New York: Greenwillow Books, 1986. (An airplane take-off is described. The plane passes over cities, countries, lakes and more.)
The Galaxies. David Darling. Minneapolis, Minnesota: Dillon Press, 1985. (Galaxies are explained.--how they were formed and the types of galaxies.)

The Glorious Flight. Across the Channel with Louis Bleriot. Alice and Martin Provensen. New York: Viking Penguin, Inc., 1983. (A biography of the man whose fascination with flying machines produced the Bleriot XI which in 1909 became the first heavier- than-air machine to fly the English Channel.)

Goodnight Moon. Margaret Wise Brown. New York: Harper and Rowe, 1947. (The classic story of a child's day ending. The moon in the night sky is told goodnight as little rabbit tells about pictures on the walls of his room.)

Great Valentine's Day Balloon Race. Adrienne Adams. New York: McMillan Publishing Co., 1980.

Happy Birthday, Moon. Frank Asch. New Jersey: Englewood Cliffs, 1982. (A little bear talks to the moon. He imagines that the echoes really respond to him.)

Hiawatha. Henry Wadsworth Longfellow. New York: Dial, 1983. (Eastern Woodland Native American legend about the moon, the Milky Way and rainbows.)

How the Sun Made a Promise and Kept It. Retold by Margery Bernstein and Janet Kobrin. New York: Charles Scribner's Sons, 1974. (Long ago the sun went wherever he wanted to go. When ever he went away, it became dark and cold. So the god Weeseke-jak decided to catch him, which was a big mistake. The earth became too hot. Finally the beaver released the sun.)

I Feel the Same Way. Lilian Moors. New York: Athenum, 1967. (A book of poetry, depicting nature from a child's point of view.)

I Saw a Rocket Walk A Mile: Nonsense Tales, Chants and Songs From Many lands. Carl A. Withers. New York: Holt, Rinehart and Co., 1965. (Folklore poems that deal with space.)

My First Book About Space, a question and answer book. Dinan L. Moche. Racine, Wisconsin: Western Publishing Co., Inc., 1982. (An informative book for primary children that tells about things that are different about earth and space.)

My Space Adventure. Karen McGraw Hefty. Milton, Florida: Create a Book, 1982. (This story tells about the planning a space trip to planet LOVE . The book is personalized with names and places.)

My Trip to the Space Station. Jane Hodges. Edisto Island, South Carolina: Edisto Press, 1987. (This book talks about the NASA astronaut children who want to visit space. They've been taught about things in space and are finally ready to mike their first trip. They go into space via a shuttle, visit the space station and use space supplies, play with the toys in space and do experiments in space.)

On the Moon. Angela Grunsell. New York: Franklin Watts, 1983. (Describes Aldrin's, Collin's and Armstrong's trip to the moon and what they did on the moon.)

Other Worlds David Darling. Minneapolis, Minnesota: Dillon Press, 1985. (Examines the evidence which may support the possibilities of life elsewhere in the universe and discusses the efforts we have made to pick up signals from outer space.)

Parachute Play. Liz and Dick Wilmes. New York: Building Blocks,1985.(Activities that can be done with outdoor parachute play.)

The People Could Fly. Virginia Hamilton . New York: Knopf, 1985. (A book of Black folk tales).

Race for the Moon. Robin Kerrod. Minneapolis, Minnesota: Lerner Publication, 1980. (A question and answer book about the moon and space missions to the moon. Includes an index of US manned space flights.)

Ready for Take-Off. Robin Lawrie. New York: Pantheon Books, A Division of Random House, Inc., 1971. (The description of how an airplane flies, beginning with a discussion on gravity and how an airplane is able to rise. A plane flight from take off to landing.)

Regards to the Man in the Moon. Ezra Jack Keats. New York: MacMillan Publishing Co., 1981. (The book tells about a boy who is unhappy because his friends laugh and call his father the "junkman". His father shows him that with great imagination using the junk they can travel through space.)

Rockets and Astronauts. Brenda Thompson and Rosemary Giesen. Minneapolis, Minnesota: Lerner Publications, 1977. (Traces the development of astronautics from the first unmanned artificial satellites through lunar landings to plans for space stations and extensive space travel.)

Rockets and Missiles. Griffith Jones. Windermere, Florida: Rourke Enterprises, Inc., 1982. (Discusses sounding rockets, orbiting, satellites used for weather, communications and mapping purposes, shuttle rocketry, and missiles. Actual photographs.)

Satellites. Kate Petty. New York: Franklin Watts, 1984. (Defines and explains satellites and their usefulness to us.)

Satellites in Outer Space. Isaac Asimov. New York: Random House, 1960. (Satellites that take pictures of the far side of the moon are described. TV programs are sent across the Atlantic by satellites as well as pictures of the real shape of the earth are shown.)

Saturn. Seymour Simon. New York: Morrow, 1985. (Saturn is described-its rings and moons with actual photography.)

Sky Dragon. Ron Wegen. New York: Greenwillow Books, 1982. (Three children look up at snow filled clouds in the sky and see them as various animals which given them an idea of what to build out of the snow.)

The Solar System. Isaac Asimov. New York: Follett, 1975. (Introduces the solar system and the characteristics of the planets.)

Space. Rochelle Goldstein. Windermere, Florida: Rourke Enterprises, Inc., 1982. (Includes discussions of space probes, Skylab, space shuttles, solar energy, space colonies and the space telescope.)

Space. James A. Seevers. Milwaukee, Wisconsin: Macdonald-Raintree, Inc., 1978. (Defines and explains the various aspects of space exploration-gravity, rockets, satellites, manned space flights.)

Spacecraft. Michael Jay. New York: Franklin Watts, Ltd. ,1980.(An easy-read fact book that discusses all types of space craft and their purposes.)

Space Machines. Larry A. Ciupik and James A. Seevers. Milwaukee, Wisconsin: Raintree Children's Books, 1979. (Using photographs describes a variety of equipment for use in space, including space laboratories and stations, mining machines and transporters.)

If I Flew a Plane. Robert Quackenbush. Englewoods, New Jersey: Prentice Hall, Inc., 1970. (This story describes a boy's dreams of what he will be when he becomes a man. This time the boy is a future pilot trying to decide what kind of aircraft he will be flying. He tries out various kinds: Passenger, cargo, sport, sky writers, spaceships, helicopters and a glider.)

In the Air. Edward Ranisbotton and Joan Redmayne. Cleveland, Ohio: Modern Curriculum Press, 1983. (This open-ended book gives the child activities in reading and thinking.)

Jet Bed. Janis Asad. Cleveland, Ohio: Modern Curriculum Press, Inc., 1981. (A primary reader featuring short vowels. Ken dreams that his bed turns into a jet. He falls off the jet and the web men capture him. They tug at his leg, but then he wakes up to find it is only a dream.)

Jets and Rockets. Barker, Allen. London: Chapman and Hall, 1959. (100 experiments including air is real, air can push, action and reaction, how jet engines develop thrust, the air intake and compression, combustion, chamber, the turbine, will jets get to the moon, how rockets work.)

Journey to the Moon. Erich Fuchs. New York: Deldcorte Press, 1969. (A wordless picture book of a space flight of Apollo 11 In the front of the book is a narration of the pages.)

Jupiter. Seymour Simon. New York: William Morrow and Co., Inc, 1985. (The book gives a vivid description of the characteristics of the planet Jupiter and it's moons shown through photographs sent back to earth by Voyager spaceships.

Let's Find Out About Space Travel. Martin Shapp and Charles Shapp. New York: Watts Publishers, 1971. (The book highlights the history of man's urge to travel in space. It covers the space flying machine inventions and the first astronauts.)

Little Plane. Michael Gay. New York: Macmillan, 1983. (A story about a little plane as he sets off for a day in the sky. He does somersaults, races with the birds, rests on a cloud and finally returns home for a well earned nights sleep.)

Many Moons. James Thurber. New York: Harcourt, 1971. (The classic story about the perception of the moon as a small object. The discussion about perception could be introduced.)

The Mars Landing. Leila Boyle Gemme. Chicago: Children's Press, 1977. (Details the exploration of the planet Mars and the landing of the Viking spacecraft with photography that has been beamed back to earth.)

Meteor! Patricia Polacco. New York: Dodd, Mead and Co., 1987. (The children with grampa and gramma were all frightened when something landed in the front lawn. Everyone in the town came to see the meteor. The people who touched it said they felt some thing magical and special. True story.)

Mission Outer Space. Robin Kerrod. Minneapolis, Minnesota: Lerner Publications Co., 1980. (A question and answer book bout space and the planets and man's attempts to learn about them through manned space missions.)

Moon. Gordon Davies. New York: Wonder Books, 1977. (An easy reader book describing the astronauts journey to the moon, their landing and what they did on the moon. The phases of the moon and telescopes are also explained.)

Mooncake. Frank Asch. Englewood Cliffs, New Jersey: Prentice-Hall, 1983. (A small bear builds a rocket to go to the moon, hibernates, and awakes to find himself in unfamiliar snow. He decides it's the moon, returns to hibernations and awakes, none the wiser.)

The Moon Jumpers. Janice May Udry. New York: Harper and Row, 1959. (A description of playing in the moonlight
Moon Man. Tomi Ungerel. New York: Harper and Rowe, 1967 (A fantasy picture book about the man-in-the-moon. He comes to the earth, goes through the phases and returns to the moon.)

The Moon Ride Rock Hunt. Margaret Friskey. Chicago: Children's Press, 1972. (An easy-to-read book of the Apollo 15 landing on the moon, their discoveries about the moon and the lunar rover with many photographs.)

The Moonwalk Adventure. Margaret Friskey. Chicago Children's Press, 1970. (A true book of the moonwalk adventure. Photo graphs and simplified text depict the operations of the Apollo 11 lunar landing.)

Space Shuttles. Margaret Friskey. Chicago: Children's Press, 1982. (Using some NASA photographs in text, the book describes the operation and use of space shuttles.)

Space Shuttle. Nigel Hawkes. New York: Gloucester Press, 1983. (Describes various space shuttles and how they work.)

Space Shuttle. Kate Petty. New York: Watts, 1984. (Describes a typical space shuttle trip including launch, flight missions, space walks, reentry and landing and looks at how shuttles may be used in the future.)

Squawk to the Moon, Little Goose. New York: Viking, 1974. (A story about a goose who learns about the moon. The theme of disobedience and self-reliance is portrayed.)

Star Boy. Paul Goble. New York: Bradbury Press, 1983. (A Blackfeet tribal tale about the sun, morning star and the people.)

Star Wars. Wayne Douglas Barlowe. New York: Random House, Inc., 1978. (A pop-up book on the characters from Star Wars. Artoo Detoo, C-3PO, Gatoonine Desert, Sandpeopl riding Banthas, Chewbacca, X-wing fighter, Darth Vader, Obi-wan Kenobi, Luke; Princess and Death Star. Few words with very good illustrations and paper engineering.)

Stepping Into Space, Eyes in the Sky. David Baker. Vero Beach, Florida: Rourke Enterprises, Inc., 1986. (This book shows photographs and explains satellites, telescopes, the Skylab space station, and the Hubble space telescope.)

2-B and the Rock 'n Roll Band. Sherry Paul. Cleveland, Ohio: Modern Curriculum Press, Inc., 1981. (A picture book telling about 2-B, a robot, who no one wanted until a little boy discovered the robot's talents for singing. Thus he became useful after all.)

2-Band the Space Visitor. Sherry Paul. Cleveland, Ohio: Modern Curriculum Press, 1981. 2-B is already on earth and C-U lands on earth. Together they see all the children dressed up for Halloween. They are so scared of the earth monsters that they get back into the spaceship and go home.)

When I Go To the Moon. Claudia Lewis. New York: MacMillan Co. ,1961. (This story mentions many facts about the earth as seen from the moon. A child-space explorer explains what is happening from the perspective of being on the moon.)

Why the Sky is Far Away. Mary Joan Gerson. New York: Harcourt, 1974. (The Nigerian story of the Garden of Eden)

Why the Sun and Moon Live in the Sky. Elphinstone Dayrell. New York: Houghton Mifflin, 1968. (The African folktale of how water visited the sun and moon with so many friends that they were driven up into the sky.)

You Will Go to the Moon. Mae and Ira Freeman. New York: Random House, Inc. 1971. (A beginning reader book of a spaceflight to a space station and the moon.)

ADDITIONAL ITEMS THAT YOU CAN PURCHASE TO SUPPLEMENT THE AEROSPACE ADVENTURE

1) Children can role play living in space as they play in the inflatable plastic shuttle available from Myra Halpin and Associates, 605 Hammond, Durham, NC 27701, @$49.95, including the text. The sample script with 54 NASA slides are available @ $49.95 and the Kodak diffusion sheeting to attach to the shuttle aft wall to simulate a window available @ $5 from the same address.

2) Jump suits similar to the 'real' astronauts are available in size small (child astronaut blue jumpsuit with patches and zippers) @ $59.00 from Space Port USA. Write TWRS, Kennedy Space Center, FL 32899. A less expensive blue jumpsuit in sizes xxsmall to xxlarge are available for $25 from Civil Air Patrol Bookstore, Bldg 749, Maxwell AFB, AL 36112 (request catalog before ordering). NASA patches can be purchased from Space Port USA to attach. Infant jogger sets can also be used to dress-up dolls and used in the role-playing situations. They can be used for preschool children as well. The outfits have NASA logos and patches (sizes 3/6, 6/9,12,18,24 months and sizes 2-7 @$16.70). Also available are Freeze dried ice cream($1.80) and an inflatable 12 inch globe ($4) from the Space Port USA.

3) Children can enjoy building space stations with Lego Land Space Systems models. The surface rover and astronauts and space station kits are available in various sets, starting at $2.29 (recommended for ages 6-12). They are available at most toy stores or can be ordered from Classic School Products, P.O. Box 160066, Altamonte Springs, FL 32716-0066 (request catalog). Ramagon Basic Builder extends the Lego experience into dimentional space station structures. They are available for $25.00 from Discovery Toys.

4) For an extension of the constellation search, Star Finder illustrates all the major star patterns and is printed in luminous ink. It is also available from Discovery Toys for $3.98. Children can find a constellation and form it with adhesive stars (under 5years), stick-on stars or tin foil to black or blue construction paper.

5) Aviator Country (Box 181,1216 Forth Rd., Lyons, WI 53148) carries numerous aviation and space appropriate products from clothes and patches, to books and models. Request catalogue!

6) Parachute play can be enhanced by Dick and Liz Wilmes' book, PARACHUTE PLAY (see bibliography). Sometimes military bases have old parachutes available. Commercial multicolored parachutes are available for

$29.95 (6 ft. diameter) or $49.95 (12ft. diameter) from Childcraft Education Corp., 20 Kilmer Rd., P.O.Box 3081, Edison, NJ 08818-3081.

7) Blue cotton material (1 to I 1/4 yards @ approximately $2) can be made into a sleeping bag by sewing the bottom and sides, leaving one side open halfway. Attach velcro strips along the open side, so the child can get in easily. Velcro is also very inexpensive and found at most fabric shops.

8) "Amazing Musical Moments!" records an excellent movement song, Astronaut's Adventure (Look At Me, P.O. Box 135, Wheeling, Il 60090 @ $9.95 for record or tape.) Rendezvous" is a musical piece by Jean Michel Jarre written for Ron McNair to play on his saxophone in the shuttle, the first musical piece to be played and recorded in space. (Poly Gram Records, Inc.)

9) Be sure the children have as many props as possible as theypretend to go on their space adventure. List the items necessary to go on board that have been presented in this text, i.e. dehydrated food (remember baby food is ideal and the lids are even color coded by food group), dehydrated drinks, plastic utensils, styrofoam meat tray with yarn attachments or a small plastic tray (an airline dessert tray is ideal) with velcro on the back, and other food items.Personal hygiene kits should include handiwipes (or a small bar of soap and a washcloth), small toothbrush and toothpaste, plastic razor with the blade removed with shaving gel, shampoo,etc. Sample packs such as those provided in motels are ideal. The astronauts were also allowed to carry their favorite personal item on board, so allow the children the same opportunity, but remind them to choose a small, lightweight item. The space suit (helmet, back pack, jacket, etc.) and sleeping bag with eye mask or sunglasses and ear plugs should not be forgotton. The activities taken on board could include the make and take activities or completed folder games described in the text, as well as the NASA Toys in Space (see Suggestions for Shuttle, item 12). Children should be reminded that they will be in space a long time and must not forget anything! They must have enough work to keep them occupied. The storybooks, drawing paper and writing utensils are also necessary items on the voyage.

SUGGESTIONS FOR USING THE INFLATABLE PLASTIC SHUTTLE CABIN IN EARLY CHILDHOOD

1) The shuttle should be constructed as specified in the manual, THE ENTERPRISE AND BEYOND, Myra Halpin, by parent volunteers, high school students or the teacher.

2) DO NOT begin the unit with the shuttle! Introduce the unit on aerospace following the sequence in ***All Aboard for Space.*** Begin with weather and aviation/flight concepts. Then introduce the space concepts, beginning with the shuttle cabin. Inflate the cabin explaining how air expands. Refer to the balloon unit.

3) A teacher's aide, parent or upper grade student should monitor the fan and/or projector at ALL TIMES. When in use, the projector should be set up at the back of the shuttle next to the floor fan. The slides projecting on the back wall of the plastic shuttle on the Kodak diffusion sheeting can be advanced by the fan/projector monitor.
NOTE OF CAUTION: It is suggested that the fan guard be reinforced in 1/4 inch hardware cloth so that fingers and small objects cannot be stuck in the fan. Remove the fan grills on the front and back of the fan and insert hardware cloth cut the fan size, then replace the grills.

4) Children will be extremely excited and curious about entering the shuttle. No formal lesson should be attempted the first day. Allow the children to talk about their feelings as they enter the shuttle. Discuss how they feel about living and working in a confined space and what they must take on board for survival and recreation.

5) Once the shuttle center is introduced, a storybook such as those listed in the Annotated Bibliography, could be read and discussed. Additional books can be made available for browsing. Paper and colors could be provided and children could draw their own picture stories about their shuttle experience. Captions can be written by the teacher and the children can tell about their pictures.

6) Other shuttle activities could be the use of the completed file folder learning activities that reinforce the concepts presented previously with hands-on or real life experiences. These activities are designed to be self correcting and limited teacher preparation and supervision is needed, making them ideal for use in the shuttle. Children can choose from over thirty folder games that are available in this text. Remember, these folder concepts have previously been experienced through various sensory methods. The folders reinforce the concepts taught.

7) As children progress through the space concepts, the teacher can decide which concepts she/he would like to introduce inside the shuttle. She/he will have to be well prepared ahead of time, remembering to take all necessary items because once the shuttle takes off, you cannot leave to get a forgotten item! An example would be SPACE FOOD. The dehydrated baby food, water, spoons, containers, napkins, etc. all have to be assembled before entry!

8) Although the shuttle will hold 15-20 children, the recommended number is 5-8, as in any early childhood learning center. Supervision is necessary inside and outside the shuttle. The teacher should use the shuttle center only on days that an aide or parent volunteer is available.

9) Activities for students not in the shuttle should be as exciting as possible. The children love working inside the shuttle cabin and it is hard for them to wait their turn! Of course, this is an ideal time to reinforce sharing and taking turns!

10) The original astronauts had to be extremely physically fit, but today almost any healthy person will be fit enough to travel on the shuttle. Talk about how important it is to be healthy and fit to travel in space, just as it is on earth. Ask the children to play like they are astronauts. They must learn to exercise in a limited space. Have them sit in a chair in the shuttle and push their seat with their hands lifting their bottom up. Ask them to push their hands together in front of their chest or lift their body up straight, like there is a puppet string pulling them up then relax and slump down in their chair. (You may want to pretend disorientation on the playground As the children step off the merry-go-round, they will feel disoriented as in space. Up and down don't exist in space, so children can simulate this as they hang upside down on the monkey bars. Ask them if they are up or down!)

11) An early childhood script on a simulated mission follows to give the teacher an idea of what actually occurs on a mission. The script is coordinated with 22 NASA slides. Copies of these slides are available from the NASA Teacher Resource Rooms (However, they are not 'packaged' so you must pull them from a selection of over 5,000 slides). Walkie Talkies can be made or purchased to help role play the simulation. Paper cups with a knotted string through the bottom of the cup make great walkie talkies. Commercial walkie-talkies are available at most toy stores. Children can role-play their own missions after learning about what occurs or just let them use their imagination!

12) The 11 Toys in Space can be an additional shuttle activity. Children can practice using these toys, enhancing their fine motor development. Teachers can view the NASA video tape of children playing with the toys (16 minutes, fourth graders) and/or the NASA video tape of astronauts demonstrating the toys (60 minutes) in micro-gravity aboard the shuttle. Space Shuttle Discovery transported the toys on

April 12, 1985. The toys, available commercially, and the astronauts who demonstrated them are:
Commander Karol Bobko: gyroscope and metal top
Pilot Donald Williams: paddleball and 'Rat Stuff', a flip-overmouse
Dr. Jeffery Hoffman: wind-up car on circular track, wheelo and magnetic marbles
Dr. Rhea Seddon: slinky, ball and jacks
Mr. David Griggs: yo-yo
Senator Jake Garn: paper airplane

A teacher's guide on the toys is also available from Dr. Carolyn Sumners, Director of Astronomy and Physics, Houston Museum of Natural Science, Houston, Texas.

CONSTRUCT A SHUTTLE MODEL

Developed by MYRA HALPIN

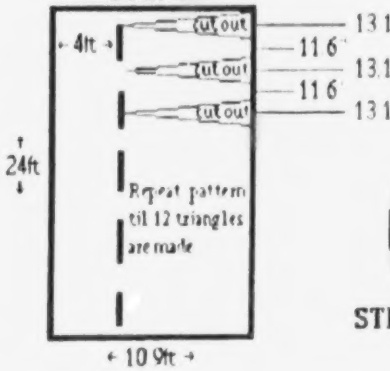
S.C. Teacher in Space Finalist

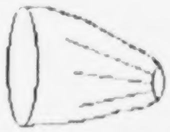
Constrct a 1/2 scale model for the crew compartment using six mill plastic.

SHUTTLE BODY

STEP 1. Cut a rectangle 24 feet long by 10.9 feet wide. Then cut 12 triangles from the rectangle as shown. Discard the cut pieces. Then, overlaping the fringed edges a small amount, tape together to form a narrowing cone. This will give the crew compartment its sloping nose. Leave tip of cone open -- do not tape. Next, using the straight edge of the rectange, connect the two corners - overlap a little - to make a cylinder.

STEP 1

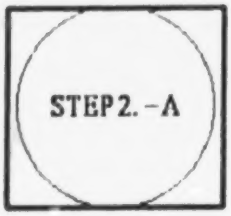




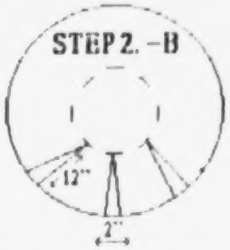
STEP 1 – completed

NOSECONE

STEP 2. Using black six mil plastic, cut a 4 foot by 4 foot square. Cut from this square a circle with the radius of two feet. Then cut 10 triangles, 2 inches at the base and 12 inches long - evenly distribute the triangles around the circle. Tape the nose cone to the narrow end of the shuttle body.



STEP2. -A



STEP 2. -B

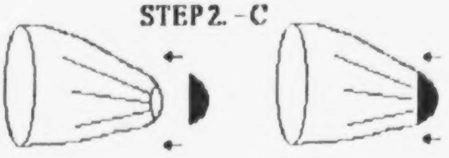
CABINWALL

STEP 3. Cut one 7.6 foot diameter circle for the end of the crew compartment. Overlap and tape this circle to the large open end of the shuttle body.

SLEEVES

STEP 4. Cut two 84 inch by 48 inch pieces from the six mil plastic. These pieces will form the sleeves that will be connected to the shuttle body.

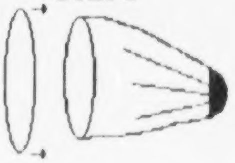
STEP2. -C



FAN PORTHOLE

STEP 5. In the large circle at the back of the shuttle body, cut a square (the same size as your fan) just about 8 inches from the bottom. Insert one end of the sleeve and overlap and tape it to the inside wall around the perimeter of the hole. Tape the other end of the sleeve tightly to the fan.

STEP 3

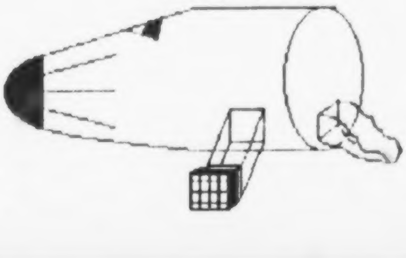


ENTRANCE PORTHOLE

STEP 6. Repeat the same process for the entrance sleeve, but place opening on the side and near the rear of the shuttle body.

Note: Fan can be placed in either porthole.

STEPS 5 & 6



TOYS IN SPACE

THE SPACE PLANE

In space a paper airplane will soar farther than on earth. The airplane's shape is important. It must be aerodynamic. It will fly forward, but will NOT fly backward. When the airplane is released with no push, the airplane will drift in the air currents. When an airplane hits the wall, it will bounce off and float backward. In space, an astronaut can blow on a paper airplane to make it fly. A paper airplane should loop in space although no looping airplane was tried on Mission 51D.

If a standard paper airplane is released with a sideways push, the airplane will twist to the right or left as it soars forward.

SPACE MARBLES

When two marbles are pushed together in space, they stick and begin to spin around their joining point. Tossed and floating marbles will stick together. As other marbles are pushed into the chain, they will attach to one end and cause the whole chain to oscillate. If enough marbles are added to the chain, the chain will move about so wildly that the two ends will come close enough for their magnetic attraction to close the chain into a circle. When the marble chain is swung around, inertial forces of the marbles trying to move in a straight line cause the chain to break. The chain always breaks between the first and second marbles - the ones closest to the center.

Astronaut Hoffman discovered that three things can happen when two six-marble circles are pushed together. The circles can repel. The circles can attach to form a figure-eight. The circles can attach to form a large circle.

GYROSCOPE AND TOP

In space a spinning gyroscope can reach about the same spinning speed as it does on earth. Its spinning will cause its support cage to spin. Because there is no friction with a support surface, the gyroscope will spin much longer. Only air resistance gradually slows down the spinning space gyroscope. Gravity causes the wobble in a gyroscope or top. This wobble (officially called Precession) increases as the gyroscope slows down on earth. In space there is no force to cause a wobbling motion. When touched by a string, a spinning space gyroscope reacts by floating away. When attached to a string and swung around in circles, a spinning gyroscope will orient its axis to be perpendicular to the string.

In space a push-top comes back up when the astronaut pulls up on the knob. To start the top, one hand must push downward on the top while the other pumps the knob up and down. For this reason, the top cannot reach the same spinning rate in space.

Commander Bobko demonstrated the value of gyroscopes by starting his gyroscope spinning and then circling around it. As he moved around, the gyroscope kept its orientation. There are gyroscopes inside the Shuttle's computer instrumentation that tell the Commander about the orientation of the Shuttle as it circles the earth.

"RAT STUFF", THE FLIPPING MOUSE

In space Rat Stuff could not stay on the wall long enough to flip. The astronauts used hand-cream to make the mouse's feet sticky enough to adhere to the wall. By the mission's end, the mouse also had a small strip of velcro to hold him to the velcro patches on the cabin wall. Astronaut Don Williams deployed Rat Stuff by winding it up and sticking it to the wall with a blob of hand cream as big as a pencil eraser.

When Rat Stuff leaned forward and then jerked backward, its feet pushed against the wall. The wall reacted by pushing the mouse away in a straight out motion. The mouse continued to flip as it sailed quickly across the cabin.

YO-YO

In space a yo-yo performs well at any speed. It will gracefully move down the string without tangling and bounce backward along the string when it reaches the loop at the end. The yo-yo will not sleep in space because there is no force to keep the yo-yo from moving back up the string. If the astronaut releases the yo-yo when it is coming back along the string, the yo-yo will continue to wind up as string as it moves past the astronaut. If the string is released on the way out, the yo-yo will wind up its string while moving forward. Yo-yo tricks involving sleeping the yo-yo (like "walking the dog" and "rocking the baby") cannot be performed in space. "Around the world" requires a sleeping yo-yo and too much room for an effective demonstration in the cabin.

Dynamic yo-yo tricks work beautifully in space. Astronaut Dave Griggs can send the yo-yo out, bring it back, and send it upward with little effort. On earth, this trick is called "shooting the moon."

JACKS

Playing jacks is a very different game in space. When the jacks player opens her hand, the jacks stick a bit to her fingers. As they leave her hand, they have some of the momentum from her opening fingers. This momentum makes the jacks drift apart. The jacks player must act quickly before the jacks move beyond her reach. If a more massive ball hits a lighter jack, it will cause the jack to fly away at a much faster speed. In a space jacks game, a dropped ball will not fall. The astronaut must throw the ball toward a wall and wait for the bounce and return. Any wall or the ceiling or floor can be used as a bouncing surface. The ball can also be tossed at any speed. Some minimum speed must be set so that the game is still challenging. If a tiny jack is given a spin, it will behave like a tiny gyroscope keeping its spin orientation as it drifts through the air.

Once while collecting jacks, Astronaut Seddon lost her footing. As she grabbed for the jack, her momentum carried her forward. She tucked her body and caused a rolling motion and a flip as she conserved angular momentum.

WHEELO

Magnetism is the same in space as on earth, so the wheel does stick to the track. By slinging the wheel sideways in a circular arc, Astronaut Hoffman could start the wheelo using a combination of inertia and centripetal force. In conserving momentum, the wheel will continue moving along the track after the track is released. It will continue spinning to conserve angular momentum. It transfers some of its angular momentum to the track as the track also begins to turn.

If the wheelo is released as the wheel is moving away, the wheel will pull the track away with it -- especially when the wheel turns the curve in the track.

CAR ON CIRCULAR TRACK

The car carried into space had an engine that could be wound- up by turning the wheels. On earth, when the engine is wound- up and released, it turns the wheels to make the car go forward on a surface. The car can also be pushed to make it go forward. In space there is no force to hold the car to a surface and, therefore, no friction. When the wound-up car is released, its wheels spin uselessly as the car floats in the air. When the car is pushed forward, it floats across the cabin but its wheels do not turn.

When a wound-up car is placed in a circular track, it begins to move forward. The track pushes in on the car to make it turn. The car reacts to this inward push by pushing outward. Once these two forces are produced, the car sticks to the track and friction occurs. With friction, the car's wheels have traction, and their turning motion makes the car move. The car's motion on the circular track slows down as the car transfers its kinetic energy of motion to the heating up of the wheels and track.

PADDLEBALL

In space paddling a paddleball is much easier. The activity can be done in any direction. The ball will float outward as it gently stretches its string. Afterward it will return to the paddle instead of falling toward earth, the paddleball player must hit the ball much harder on earth than in space. The paddleball players space style is more deliberate and graceful. If the ball and paddle are stretched apart and released, they will come back together. The paddle will twist because the string is not connected to the paddle's center of mass. As a result, when the ball reaches the paddle, the paddle is turned so that the ball passes by without any collision.

If the paddle is released after the ball is hit, the ball will reach the end of its stretch and return toward the paddle. Meanwhile the paddle will be pulled forward by the elastic string. Astronaut Don Williams was able to get the ball to return and bounce off the paddle once after he released the paddle.

SLINKY

In space, the slinky will not walk. Instead it always returns to the hand holding onto it. The slinky coils can be pushed from hand to hand much as is done on earth. The space slinky can perform a yo-yo-like behavior. The astronaut pushes the yo-yo forward. The slinky moves outward until the coils are stetched. The spring action pulls the coils back toward the astronaut and outward behind him as the slinky's behavior repeats. If the slinky is stretched apart and released, it will come together and then turn slowly.

Astronauts Jeff Hoffrnan and Rhea Seddon discovered that the slinky will carry compression waves and transverse waves. When the coils on one end of the slinky are squeezed together and released, a compression wave travels along the slinky. When one end of the slinky is swung sideways, the slinky will carry a left to right transverse wave. When a wave reaches the end of the slinky, it will bounce back along the slinky. If the compression wave or transverse wave is continually sent along the slinky, a place or places on the slinky may stand still as the wave moves around them. This is called a standing wave, and the non-moving spots are called nodes.

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SIMULATION MISSION EARLY CHILDHOOD SCRIPT

Flight crew: *See pg. 154, item 11, for suggested use.
Ground (control)
Pilot
Mission Specialist (MS)
Commander

Parts of the Shuttle (Space Transportation System-STS) Orbiter (Children should name their shuttle-this shuttle is named Atlantis
Main Engines
Solid Rocket Boosters (2)
External Fuel Tank
Payload Bay

Manned Maneuvering Unit (MMU) Special portable gear worn outside the Orbiter. Powered by compressed gas, the astronaut can travel like a rocket in space.

Slide
1 Shuttle on pad
Ground: Atlantis, this is Ground Control, radio check, over."

2 Commander on flight deck
Commander: "Ground, this is Atlantis, read you loud and clear."

3 T minus 12 minutes and 29 seconds and counting
Pilot: "Ready for lift off."

4 T minus 9 minutes and holding
Ground: "It is a go for launch. 5, 4, 3, 2, 1, O. Blast Off! Zoom!"

5 Shuttle lift off
Ground: "Beginning roll maneuver."

6 Shuttle
Ground: "Roll maneuver completed."

7 Separation of shuttle's solid rocket booster
Commander: "Solid rocket booster separated."

8 External fuel tank falls to the ocean
Commander: "We are on orbit. Time to go to work."

9 Picture taken in shuttle.
MS: "Prepare to launch satellite."

10 Communication satellite heading toward orbit
MS: "Watch the satellite spin."

11 Another view of the satellite
Pilot: "Prepare to recover the satellite."

12 Shuttle changing course
Commander: "Recover the satellite."

13 MMU
Commander: "Hook up the MMU."

14 MMU strapped on astronaut's back allowing him to travel in space
Commander: "Houston, we are beginning the approach."

15 Communication satellite.
MS: "Be very careful to grab the satellite in the center."

16 The arm (robot counter-part of the human arm)
MS: The robot arm is needed to help get the satellite into the payload bay."

17 Astronauts standing on the arm
Ground: "Roger, Atlantis. The arm is locked on."

18 Shot of hurricane
Commander: "We have spotted a hurricane."

Ground: "It must be nice flying above the weather."

19 Satellite retrieved in payload bay
MS: "Satellite is replaced in payload bay."

20 Another view of satellite
MS: "I'm coming in now. What's for dinner?"

21 Landing at Kennedy Space Center
Commander: "Mission complete!"

THE FOLLOWING NASA PRINTS WERE SUGGESTED TO SUPPLEMENT ACTIVITIES IN THIS TEXT.

Space Shuttle Lifts Off into Space (Clouds, item 6)

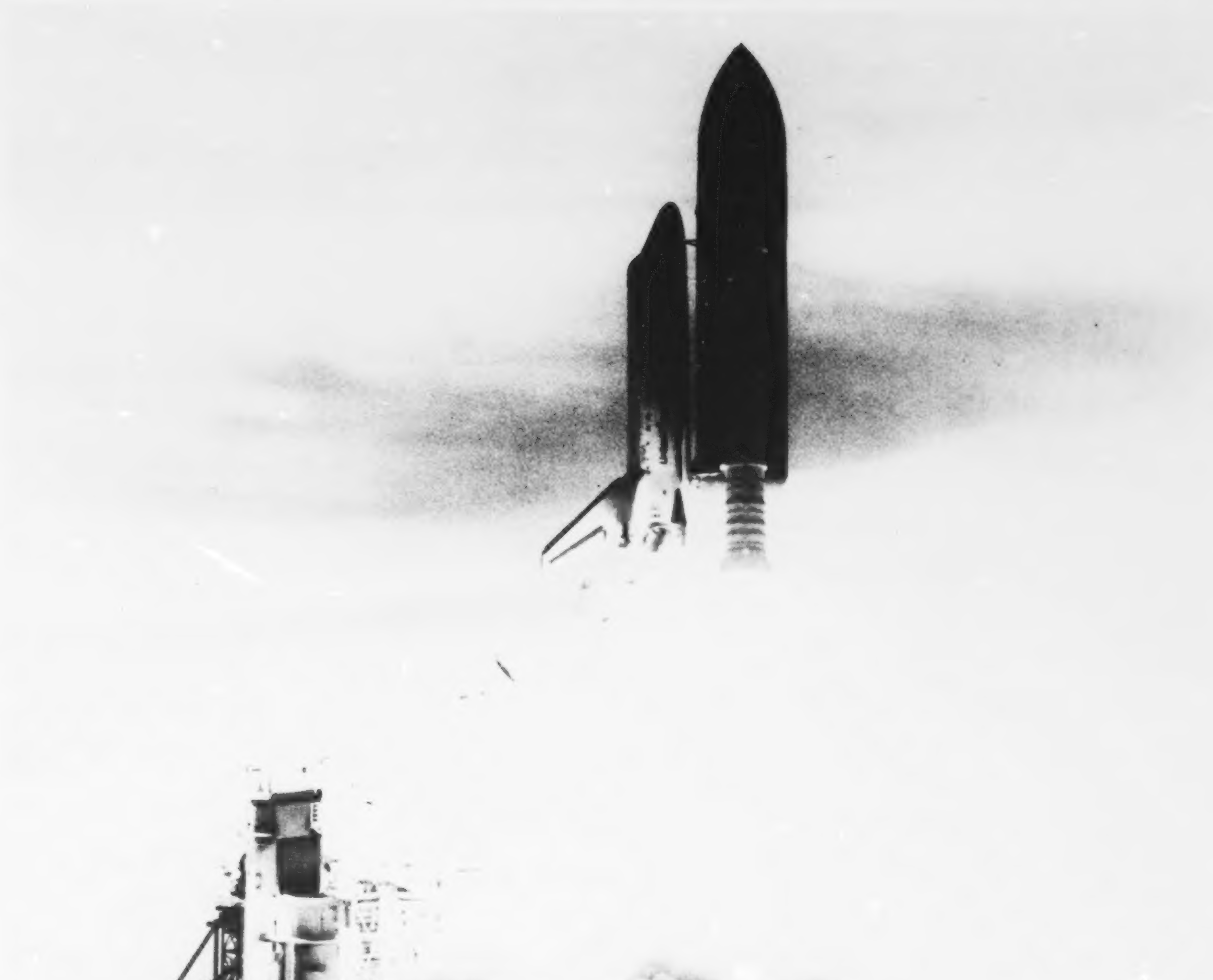
Apollo 15 Liftoff of Saturn V (Rocket, item 3)

Crew of Space Shuttle Mission STS-61A/SPACELAB D-1 Crew, left to right:
Front row: Reinhard Furrer, German payload specialist, Bonnie J. Dunbar, mission specialist, James F. Buchi, mission specialist, Henry W. Hartsfield, Jr., commander
Back row: Steven R. Nagel, pilot, Guion S. Bluford, mission specialist, Ernst Messerschmid, German payload specialist, Wubbo J. Ockels, Dutch payload specialist

McCandless Flies First Solo in Space: Manned Maneuvering Unit (MMU) (Space Suits, item 2)

Space Station Freedom artist concept (Space Station)

Apollo 11 First Human Footprints on the moon (Trip to the Moon)



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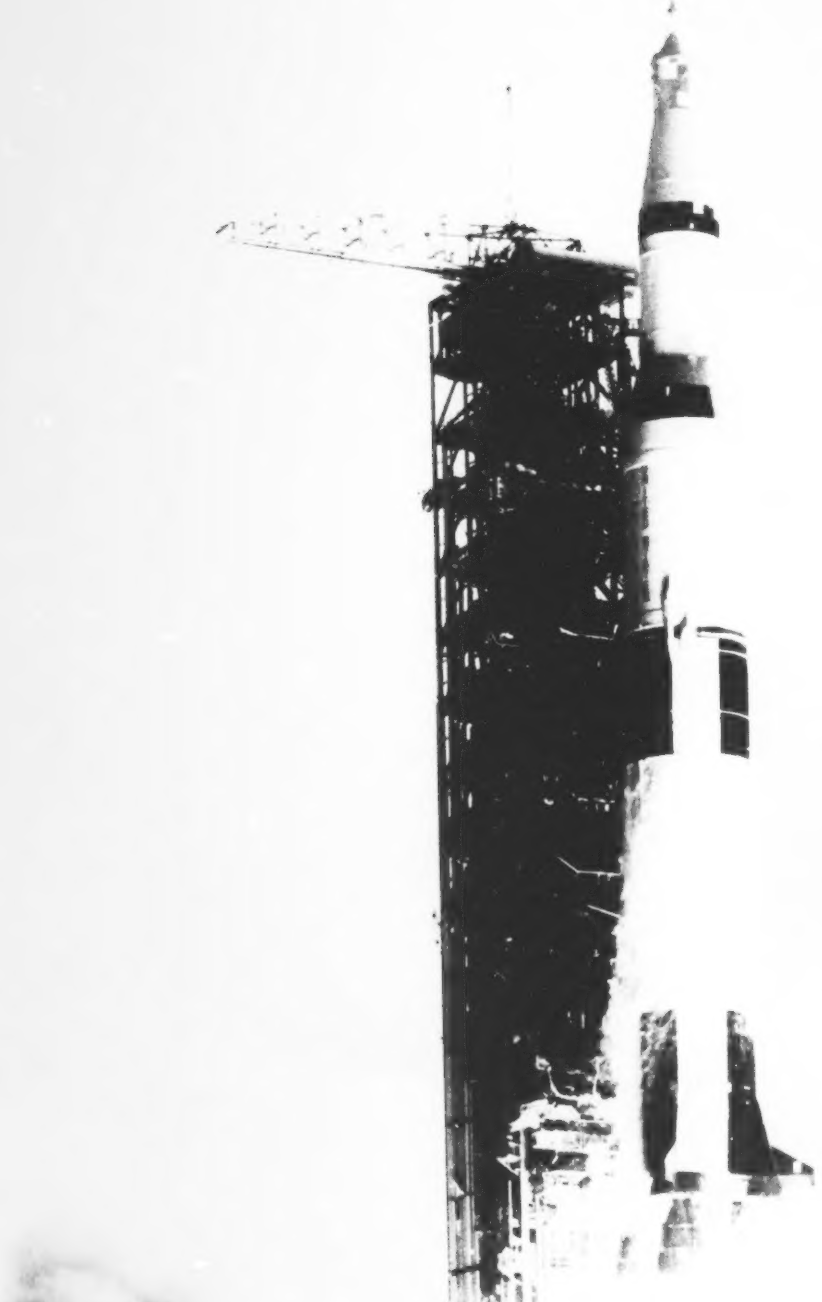

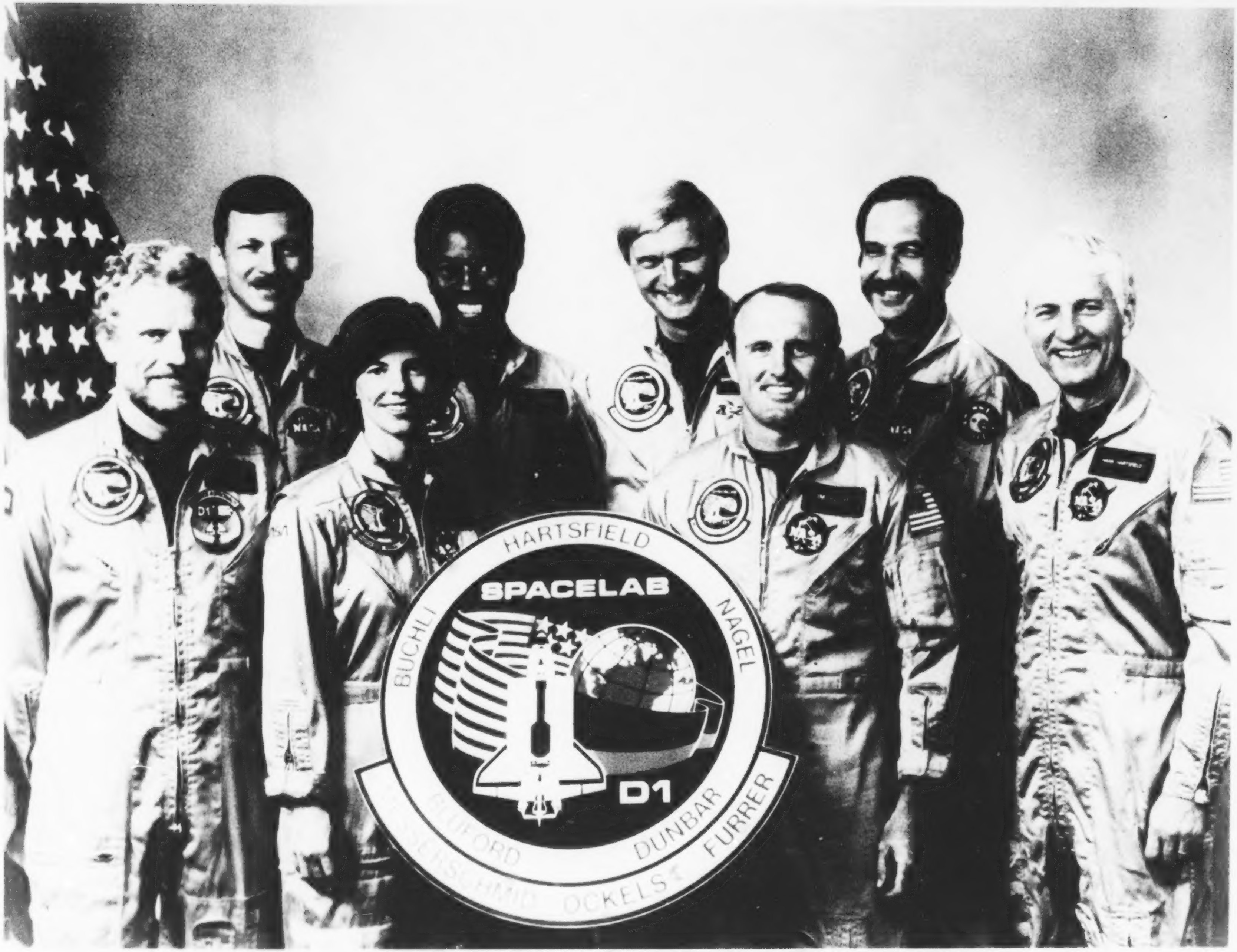
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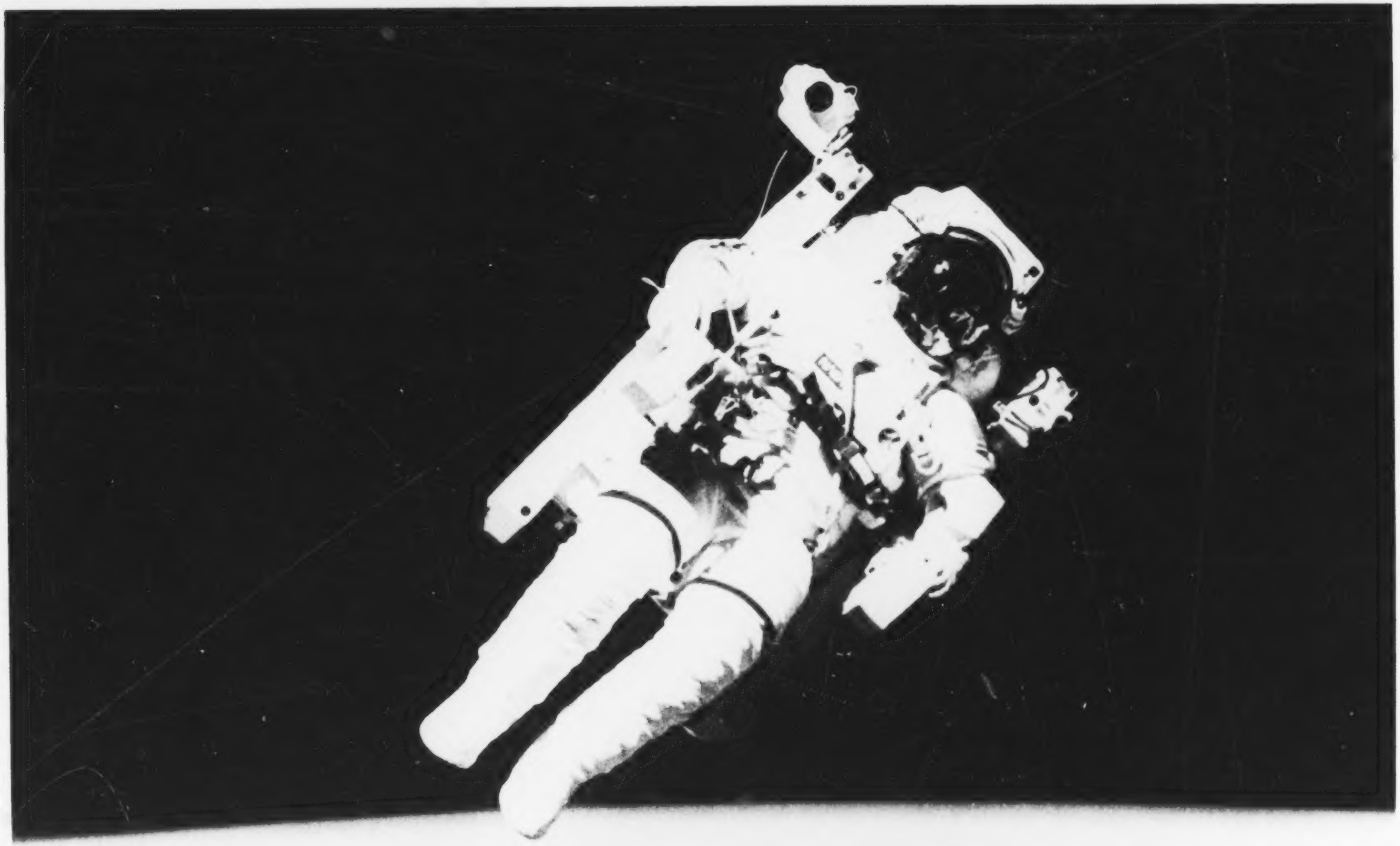
BUCHLI
NAGEL
D1
BLUFORD
DUNBAR
FURRER
SERSCHMID
OCKELS



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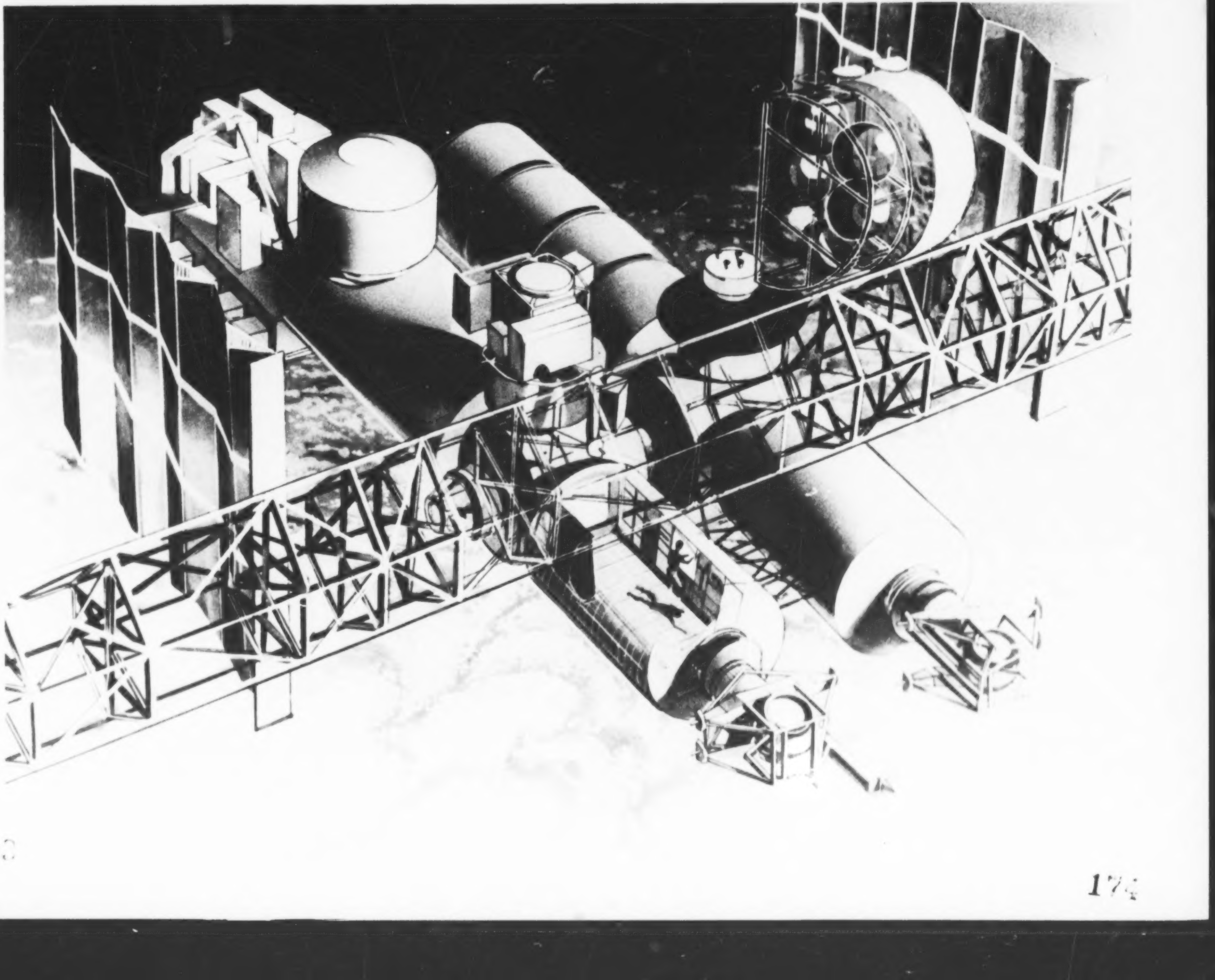

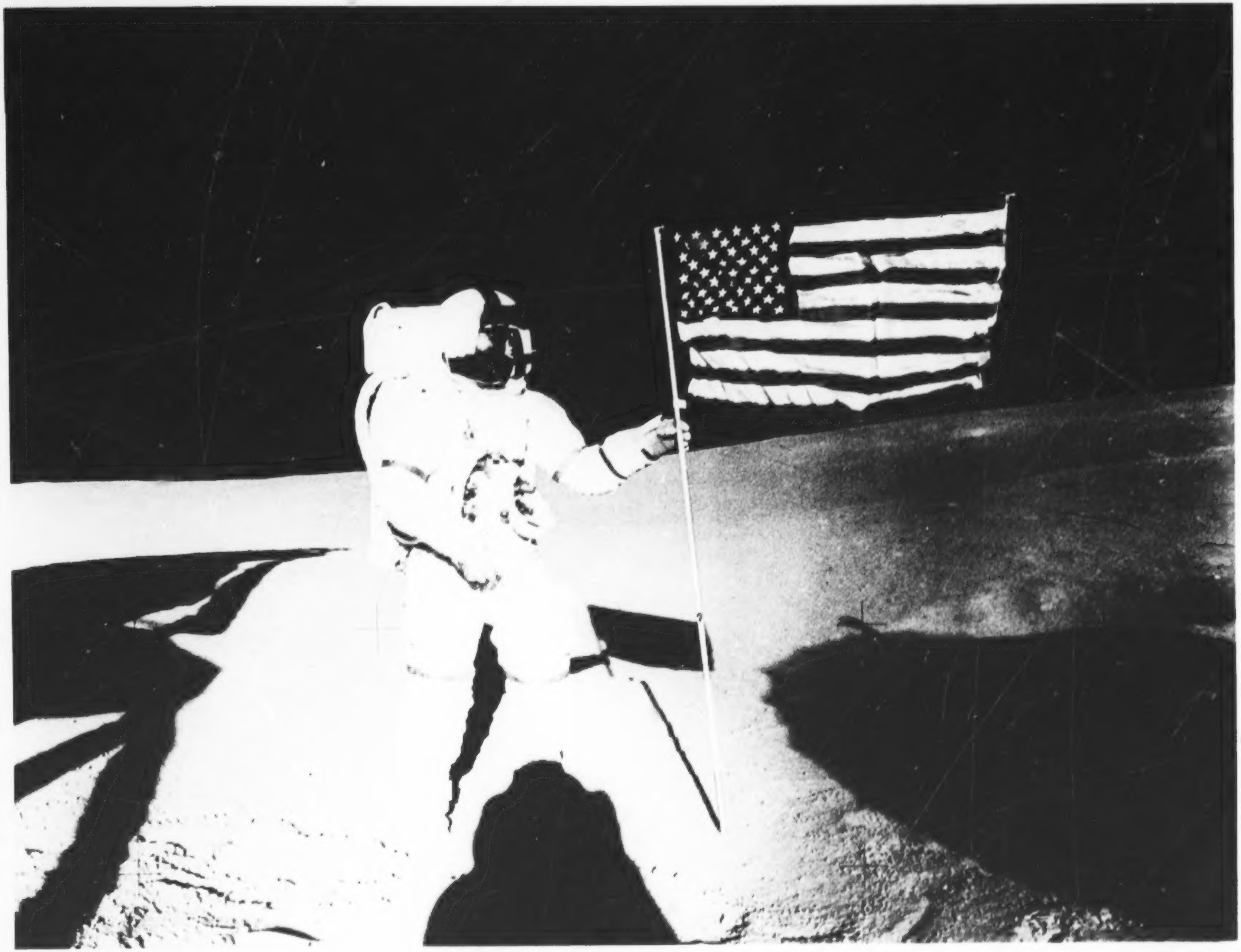

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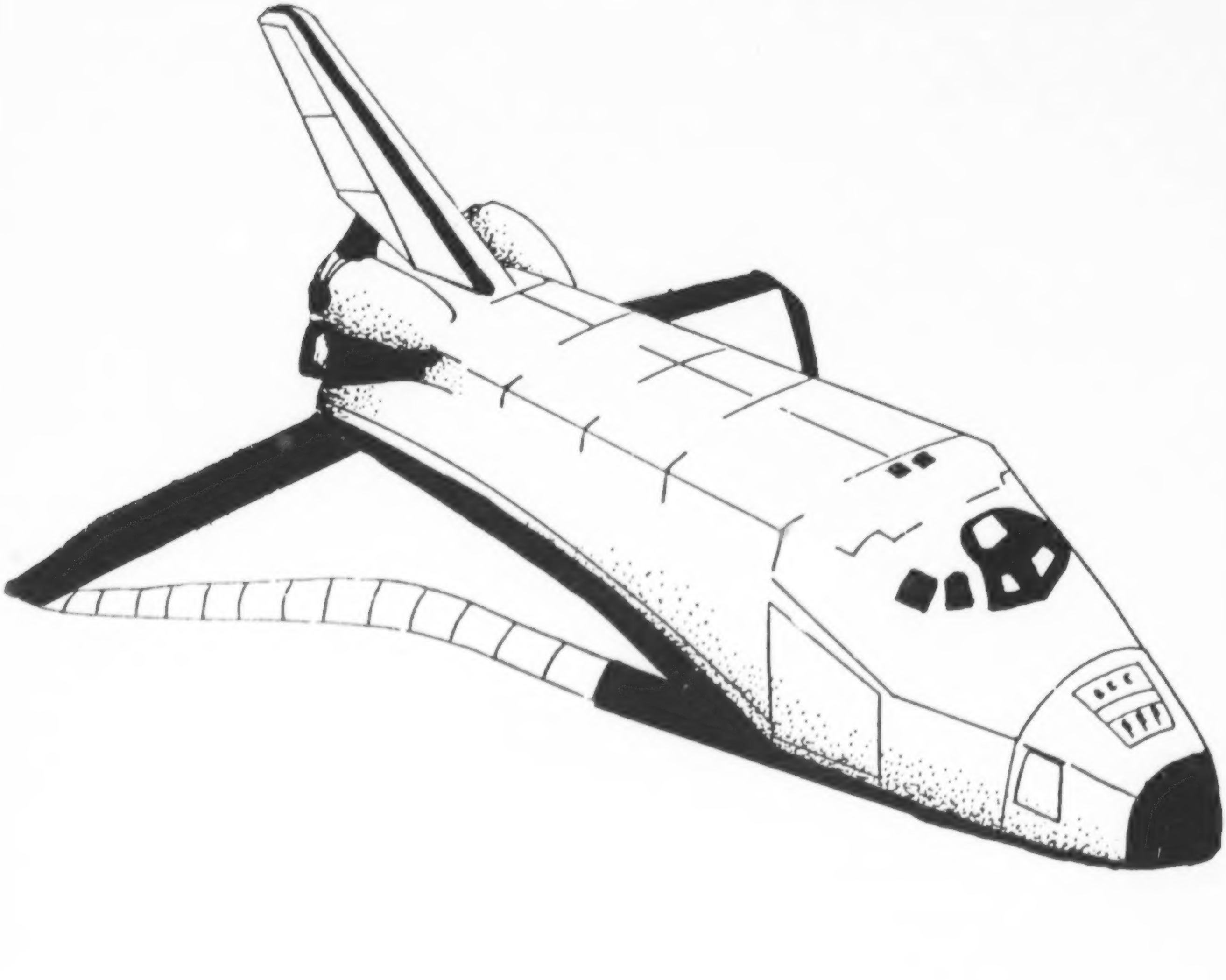

MISSION CONTROL: "We are home and safe!"

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